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Proposed Standards for Initial Machine Speeds

By ROBERT COREY DEALE*

A PROPOSAL has recently been made that the initial speeds of driven machinery be standardized. Such standardization would greatly reduce the number of sizes of pulleys, gears and sprockets necessary for driving machinery and would very much simplify the stocking of parts. As line shafting is included in the project, the transfer of machinery from one location in a factory to another would be made very much easier than it is at present. The proposal originated in the National Electrical Manufacturers' Association, and has been endorsed by the Power Transmission Association, with the National Machine Tool Builders' Association co-operating. At present there is a very great variation in the speeds of machinery, a variation that seems to be unnecessary. There are many speeds, differing from each other only by small increments. It is recognized that not all machinery can be run at the same speed, regardless of size, but there is certainly no necessity for having initial speeds of machines of approximately the same size vary ten per cent or even less. Some manufacturers have already attempted to set some sort of a standard for themselves. Other manufacturers seem to be prone to let the ini-

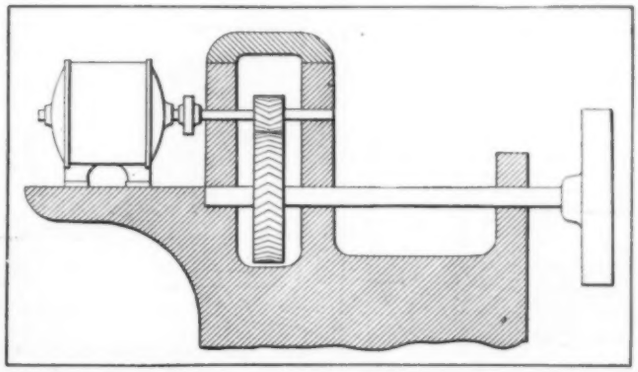

Fig. 1—Coupled-motor drive. It is proposed to standardize the speed of the shaft to which a motor is coupled

*The author represented the National Machine Tool Builders' Association at a meeting in New York City, called by the American Engineering Standards Committee.

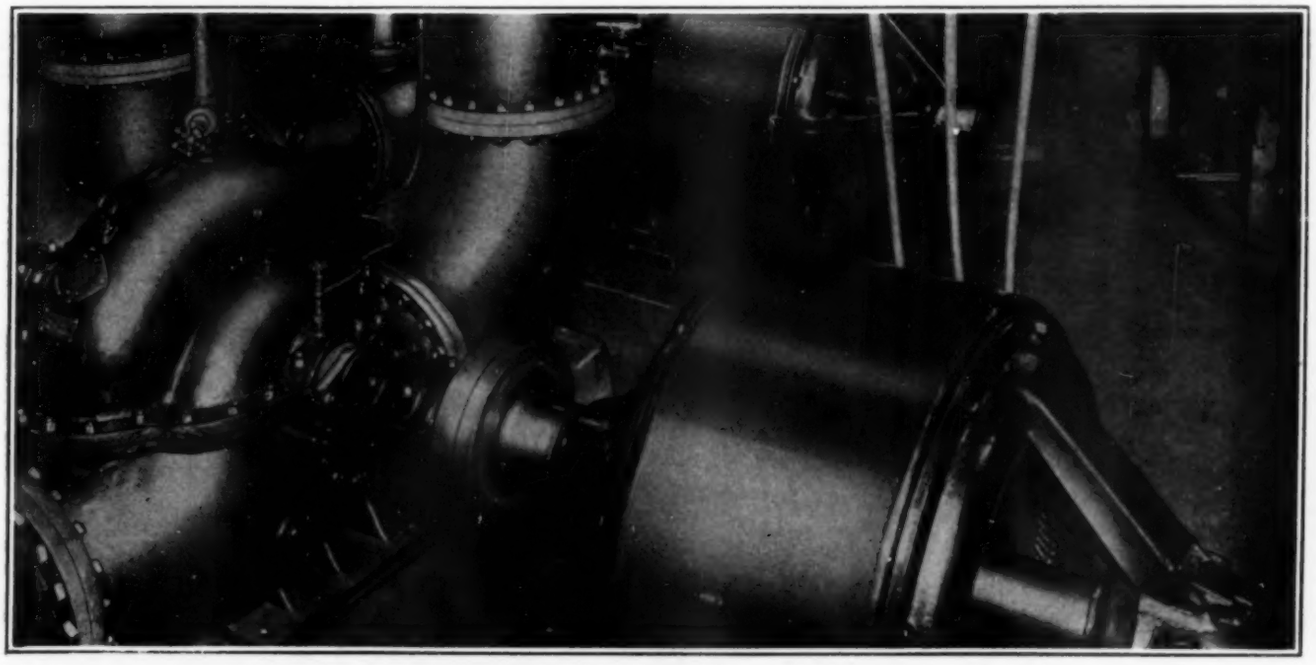

Fig. 2—Application of the coupled-motor drive

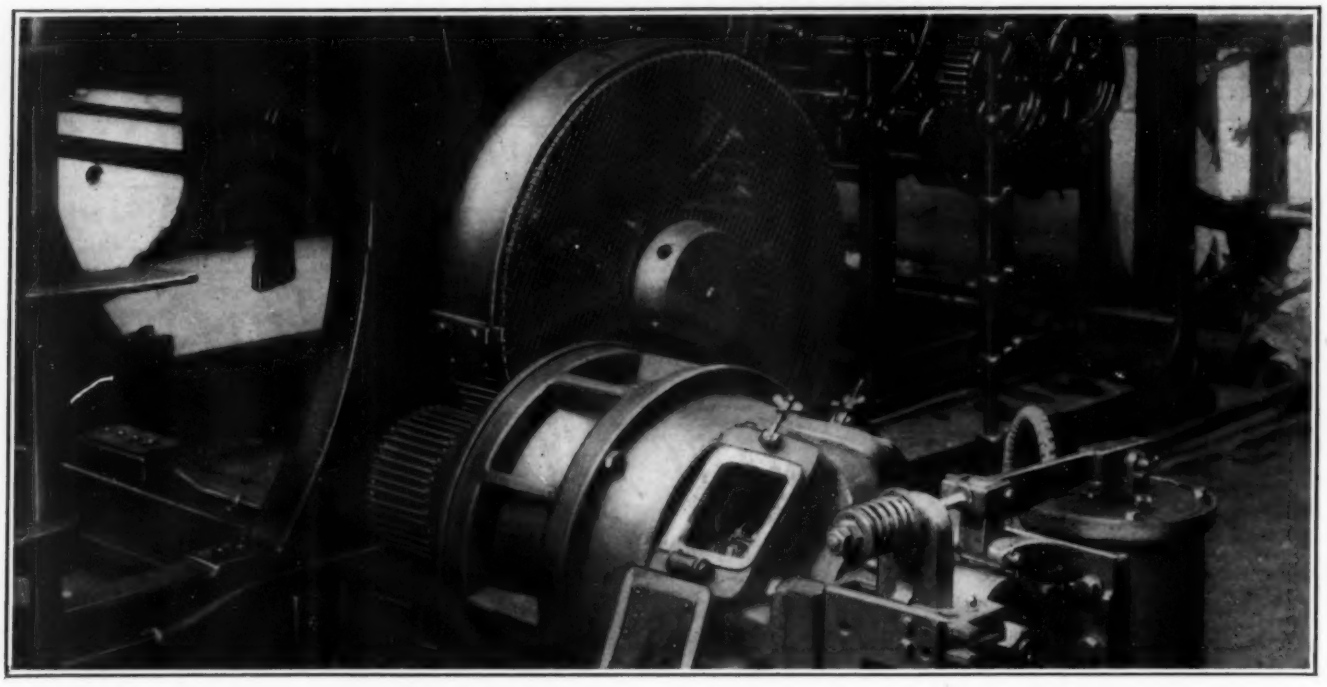

Fig. 4—Application of the geared-motor drive

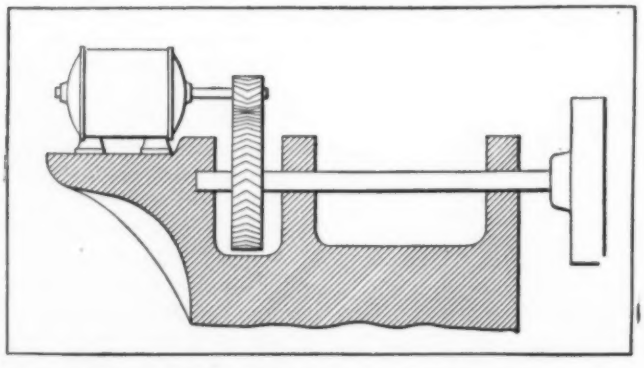

Fig. 3—Geared-motor drive. It is proposed to standardize the speed of the drive pinion

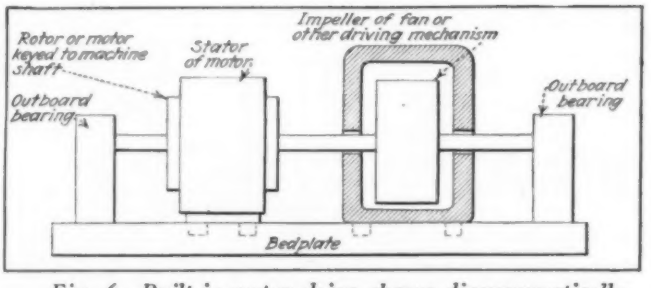

Fig. 6—Built-in-motor drive shown diagrammatically

tial speed come what it will. It should not be difficult to design machinery with variations taken care of in the gearing and with the initial speed one of a rational series. Some machines could be changed with very little diffi-

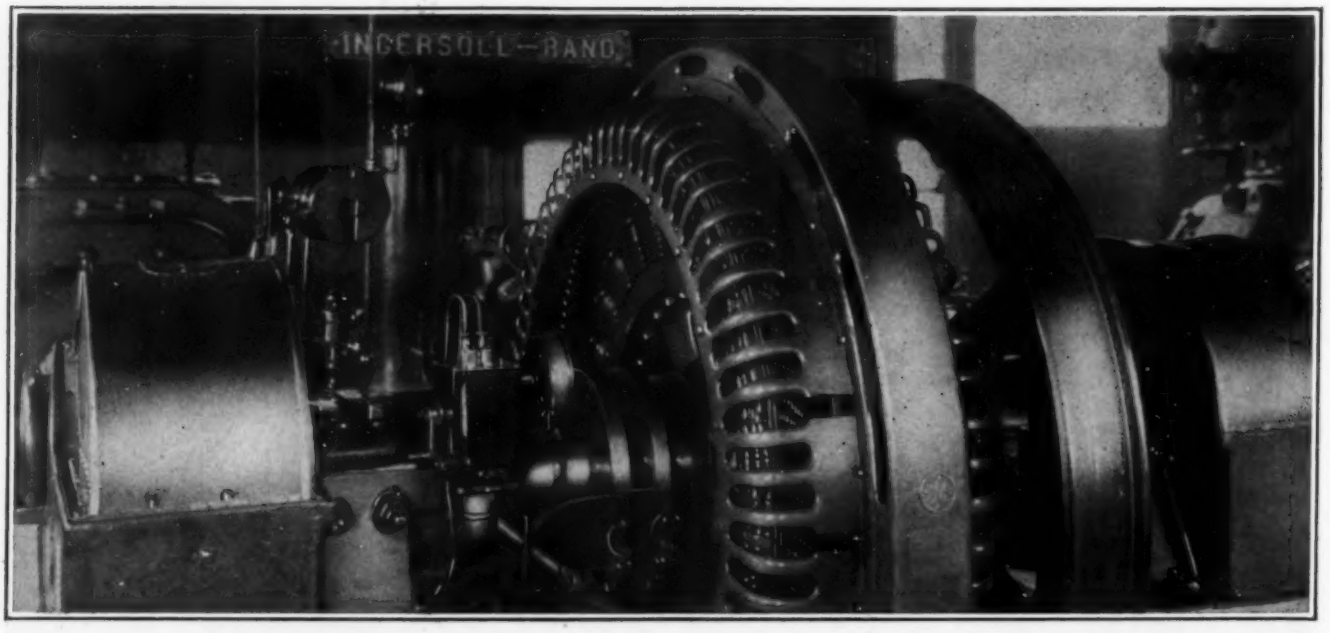

Fig. 5—Application of the built-in-motor drive. The speed of the rotating element of the motor would be standardized

culty, while others could not be brought into line without radical changes. This project is intended more as a guide for future design than as a demand for immediate changes of present machines.

The greatest possibilities probably lie in the standardization of line-shaft speeds. There has been very little standardization of this sort, even within individual shops. And it would seem that three or four line-shaft speeds should cover every contingency. In this connection it might be desirable to consider the possibility of a standard belt speed, as a guide to the size of pulleys.

Before any agreement can be reached as to a standard set of speeds, it is necessary to define just what is meant by the initial speed of a driven machine.

It is believed that the following set of definitions as to what constitutes the initial speed of a machine covers all possible types of drive.

(1)—Coupled motor drive: The speed of the shaft to which the motor is coupled.

(2)—Geared motor drive: The speed of the driving pinion.

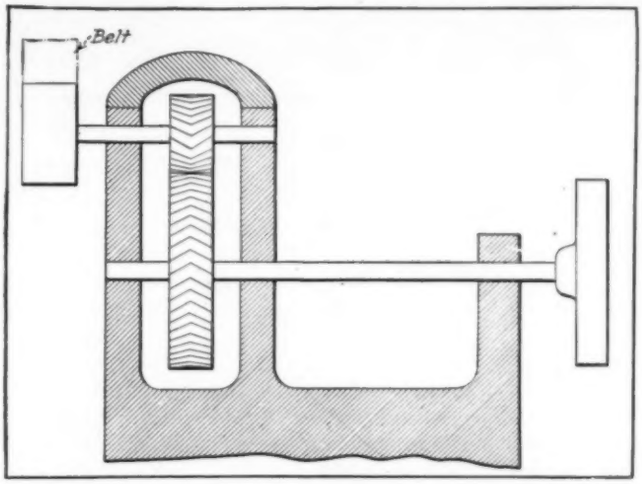

Fig. 7—Single-pulley belt drive. It is proposed to standardize the speed of the pulley

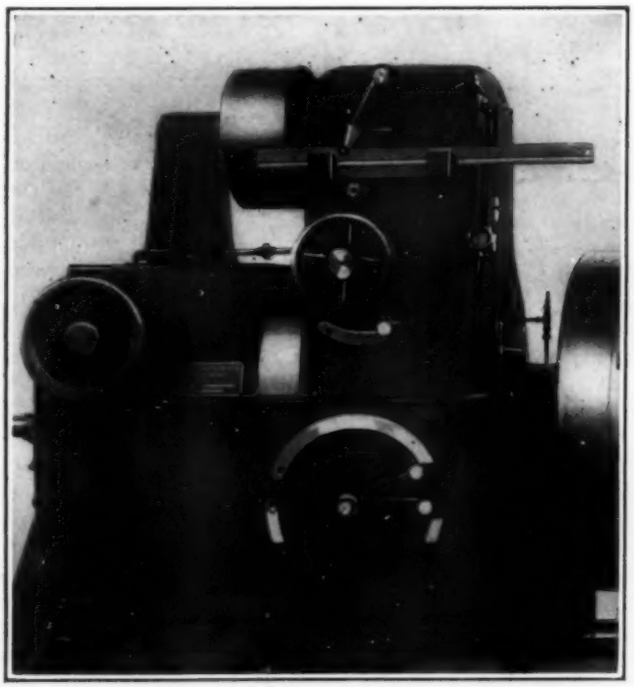

Fig. 8—Application of the single-pulley belt drive

(3)—Built-in-motor drive: The speed of the shaft on which the rotating element of the motor is mounted.

(4)—Single-pulley belt drive: The speed of the pulley.

(5)—Cone drive: The speed of the countershaft.

(6)—Motor drive through belts, chain, or equivalent: The speed of the driven pulley or sprocket.

There is little question as to definition (1). This type of drive, Fig. 1, is becoming of considerable importance, especially for heavy machinery, because of the support provided for the driving pinion, and because the gears may be enclosed in an oil-tight case and run in a spray of oil. Only the coupling is exposed, so that there is little chance of accident. Because the pinion is supported by bearings at each side, bored at one setting, the center distance of the first pair of gears may be maintained exactly, and the axes may be held parallel. The motor-driven centrifugal pump, Fig. 2, illustrates this type of drive.

The geared motor drive is shown in Fig. 3. It is similar to the coupled drive, the difference being that the pinion is supported by the shaft of the driving motor. The printing press, Fig. 4, is a good illustration of this type of drive. As the tendency of design is toward the coupled drive and away from the geared drive, it is advisable to have precise definitions of these two drives.

There has been some feeling that it is more desirable to standardize the speed of the driven gear. However, there is little or no possibility of standardizing the gears in this drive, and consequently little or no advantage in standardizing the speed of the driven gear, especially as the speed of the pinion is already standardized to a large extent by the speeds of the obtainable electric motors.

The built-in-motor type of drive has not been used extensively for machine tools, although it has been common for large, slow-speed machinery such as air compressors, as shown in Fig. 5. This type of drive, shown diagrammatically in Fig. 6, offers distinct advantages for certain types of machinery.

The single pulley belt drive, Figs. 7 and 8, likewise offers no difficulty. It seems to be related to the coupled drive, of definition (1).

The cone-drive type of machine, Fig. 9, seems to be becoming obsolete, although there will probably always be some types of machines for which the cone drive will be the most suitable. It seems desirable to standardize the speed of the countershaft.

Motor drive through short belt or chain is illustrated in Fig. 10. It is seen to resemble the single-pulley drive

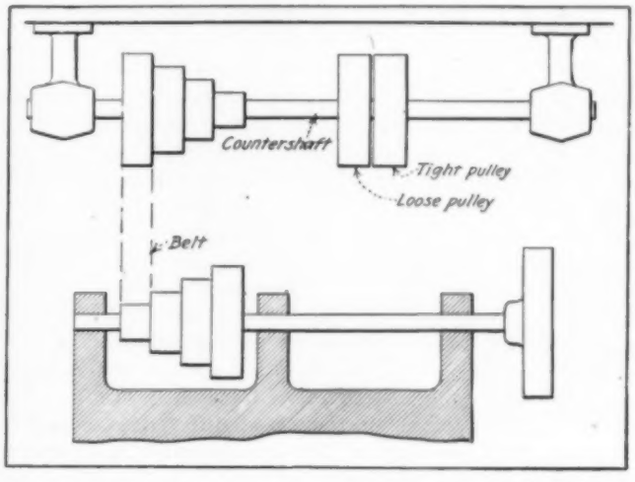

Fig. 9—Cone drive. It is proposed to standardize the speed of the countershaft

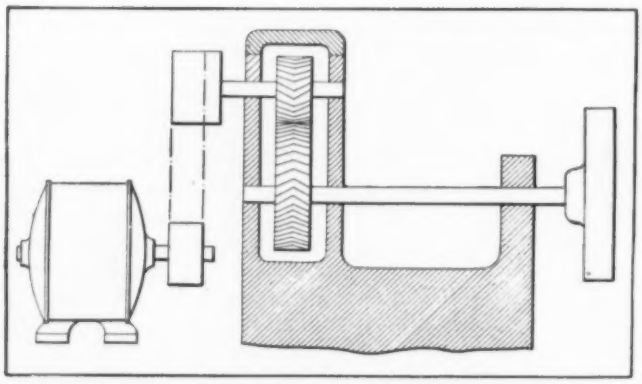

Fig. 10—Motor drive through belt, chain, or the equivalent. It is proposed to standardize the speed of the driven pulley or sprocket

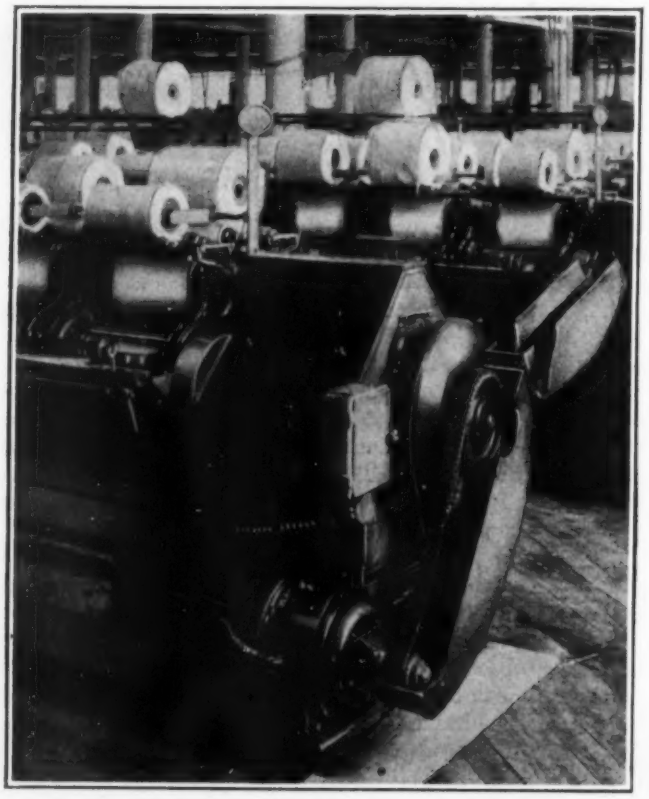

Fig. 11—Application of motor drive through belt, chain, or the equivalent

of Fig. 7. This drive, which is extensively used, obviously should be standardized as to speed of the machine pulley or sprocket, as frequently the same machine is driven by either single pulley or motor, through belt or chain. The looms, Fig. 11, furnish an example of this type of drive.

It has been recommended that the standardization of machine speeds should proceed on the basis of a table of preferred numbers. It does not seem possible to comply with this suggestion fully, since the speeds of driven machinery are tied up closely with the possible speeds of electric motors. Consequently it would seem desirable to make up a table, based on obtainable motor speeds, which would give about the same differences between adjacent speeds as between adjacent speeds of a desirable table of preferred numbers.

The 5, 10 and 20 series of preferred numbers now proposed for use by industries in the United States are given

Three Series of Preferred Numbers, Proposed Standard Machine Speeds, and Proposed Allowable Deviations

20 Series	10 Series	5 Series	Proposed Standard Machine Speeds	Proposed Allowable Deviations
10,000	10,000	10,000	9,000*	
9,000				
8,000	8,000			
7,200				
6,400	6,400	6,400	6,000*	
5,600				
5,000	5,000			
4,500				
4,000	4,000	4,000		
3,600			3,600	
3,200	3,200			
2,800				3,000
2,500	2,500	2,500	2,400*	
2,250				
2,000	2,000			
1,800			1,800	
1,600	1,600	1,600		1,500
1,400				
1,250	1,250			
1,120			1,200	
1,000	1,000	1,000		1,000
900			900	
800	800			800
720			720	750
640	640	640		
560			600	
500	500			
450				450
400	400	400	400	
360				
320	320			360
280			300	
250	250	250		
225				
200	200		200	
180				
160	160	160		
140			133	*Arbitrary Speeds
125	125			
112				
100	100	100		
90			90	
80	80			
72				
64	64	64		
56			56	
50	50			
45				
40	40	40	36	

in the accompanying table. There are listed, also, a series of proposed speeds, all except three of which are based on possible speeds of 60-cycle induction motors. As the speeds of the direct-current motors in general use follow the speeds of the alternating-current motors, this table should be entirely satisfactory except for cases of geared or coupled-motor drive by a motor of some other frequency. The allowed deviations are to cover speeds of twenty-five- and fifty-cycle motors.

It seems that no hardship would be caused designers of machinery if they were to confine the initial speeds of machines to those given in the table. The list may seem long, but it is intended to include all classes of machinery. For machinery of a given class probably not more than four or five of these speeds are necessary.

The value to industry of the proposed standardization should be large in proportion to the effort required to bring it into effect. All manufacturers and users of machinery should support the project and should be represented, at least through their trade association, when the American Engineering Standards Committee calls the preliminary conference.

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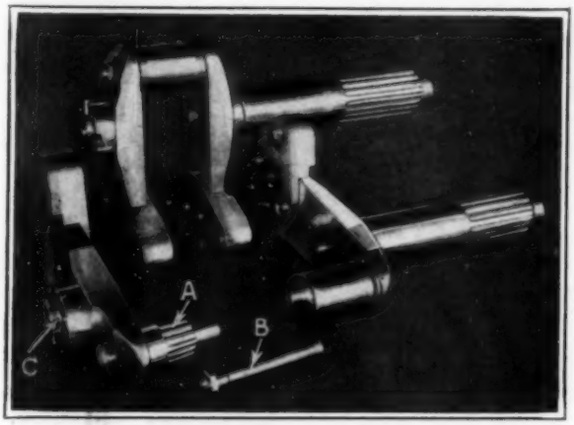


Fig. 54—The crankshaft of the "Wasp" engine

The Air-Cooled Radial "Wasp"

Making an unusual crankshaft

By Ellsworth Sheldon
New England Editor, American Machinist

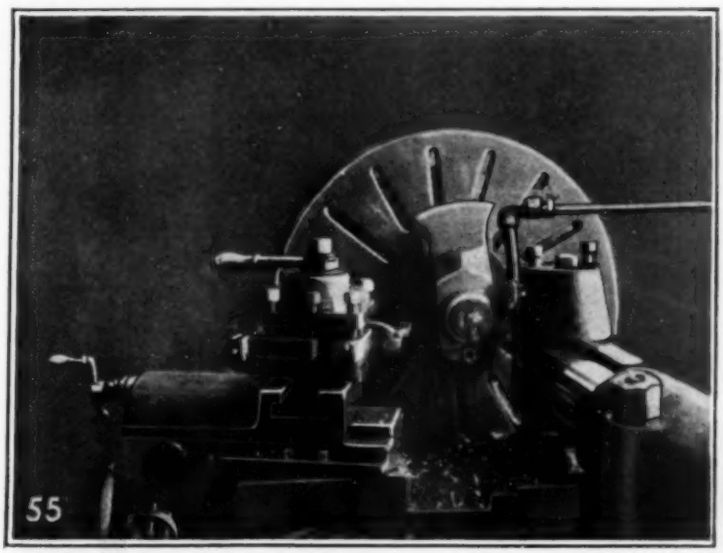
TO ASSEMBLE the crankpin bearing of an engine having a double-web crank, either the connecting rod must be made with a cap or the crankshaft itself must be in two parts. The design of the "Wasp" engine follows the latter construction, as may be seen in Fig. 54, which shows one complete shaft and the disassembled parts of another.

The bearing in the master-rod consists of two shouldered bushings, the combined length of which is equal to the distance between the crank webs of the assembled shaft. These bushings are pressed into the rod from opposite sides, meeting at the center to form a continuous bearing surface over the length of the pin. The soft metal lining of the bushings is scraped to a close running fit on the pin in the final assembly.

To balance the reciprocating weight of the pistons, master and link rods connected to the crankpin, the webs are extended beyond the center of rotation of the shaft, and to the ends heavy counterweights are attached. Before the weights are finally secured in place, however, practically all of the machine work on both parts of the shaft has been completed, and there remains only the final balancing and the assembling with the rods, before it is ready to go into the engine.

The shape of the counterweighted end of the crankweb is shown in Fig. 55, where the short end of the shaft is to be seen mounted on a special fixture in a lathe to face the back of the web and to form the short hub to which the first driving gear of the train that transmits power to the supercharger fan, is attached in the finished engine.

The tenth article. The eleventh will appear in an early issue.



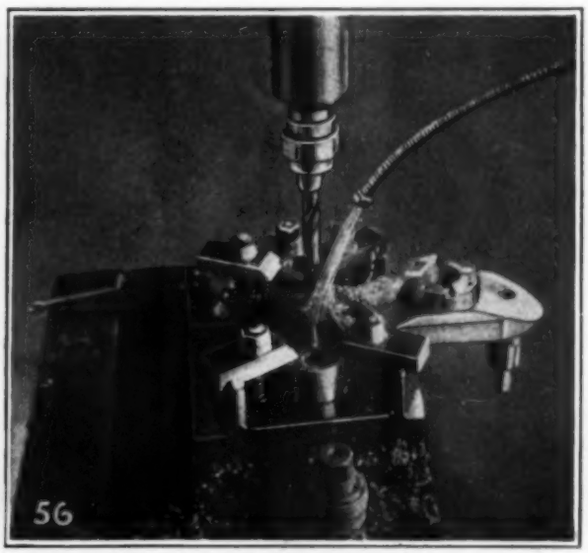


Fig. 55 — Fixtures are bolted to the faceplate of a lathe to hold the parts for machining. The dovetailed end of the web fits a correspondingly dovetailed channel in the counterweight. Fig. 56 — The previously channeled parts of the counterweight are assembled in a fixture with a web, and holes are drilled through the three parts for the rivets that hold the counterweights in place. The holes are also reamed and countersunk at the same setting

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Fig. 57 — Crankshafts are finished on all surfaces by grinding. Here the short end is shown mounted on centers in a grinding machine with a counterweighted driving plate to balance it.

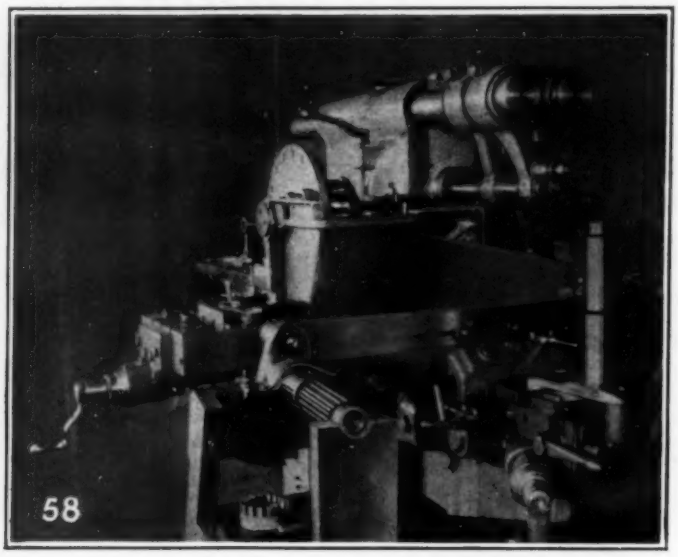

Fig. 58—A special milling fixture with a large-diameter indexing plate is employed to locate the splineways on the long end of the shaft. It is to this part of the shaft that the hub of the propellor is secured when the engine is in actual flying service

The part is first centered at opposite ends of the pin, *A*, Fig. 54, and is recentered in a lathe to insure accurate alignment of centers; after which it is turned upon the centers thus provided.

Locating from the rough-turned pin, the piece is held in the vise of a shaper while a single-point tool removes as much of the surplus stock as may be convenient, the remainder being taken off in the lathe while the web is held in fixtures similar to the one shown. A hole is drilled through the hub and is later bored to a size to fit over the studs of the various fixtures. All of the work at this stage is preliminary, since the final reduction to size on all parts except the contour of the web is effected by grinding.

The counterweights consist of two separate pieces permanently attached to each web. A channel, equal in depth to one-half the thickness of the web, is milled across each piece, and is widened at an angle toward the outer edge to match the shape of the web. When two of these counterweights are placed together, with the channel thus formed enclosing the dovetailed end of the web and the three parts bound together with rivets, it is impossible for the counterweights to become loosened by the continued action of centrifugal force.

The operation of drilling, reaming and countersinking the holes for the rivets is performed as in Fig. 56 with the three parts clamped together in a fixture in the relative positions they are to occupy. Shouldered rivets are forced into the holes under a hydraulic press and are headed over with a hand hammer to fill the counter

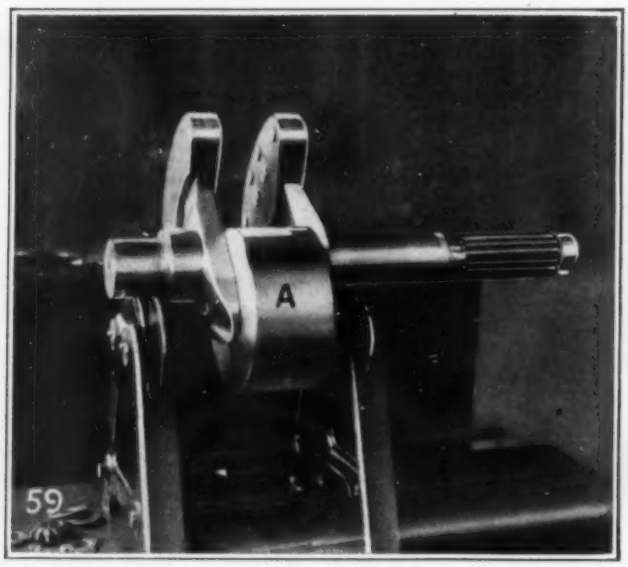

Fig. 59 — Balancing the crankshaft is accomplished on the Anderson balancing ways shown in this illustration. The large split weight represents a certain calculated proportion of the reciprocating weight to be balanced.

Fig. 60—To take off a small amount of metal from the counterweighted ends of the webs in order to bring it into balance, the crankshaft is transferred to the centers of a lathe and the stock is turned off with a tool

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sinks on the opposite side. The shouldered ends of the rivets, which are toward the space between the webs, are allowed to project, while the riveted ends are finished off smoothly.

As may be soon in Fig. 54, the main pin—which is $2\frac{1}{2}$ in. in diameter by $3\frac{7}{8}$ in. long—is hollow, and in its bore there are twelve splineways accurately located with reference to the axis of the shaft. The pin projecting from the web of the short end is splined to fit this bore, and the diameters of the plain portions ahead of and behind the splines, are ground to a close—not driving—fit in the corresponding parts of the bore.

Surface and Face Grinding

Not only are all diameters reduced to final sizes by grinding, but surface and face-grinding operations are performed on the flat sides of the web. The necessity for accuracy as nearly absolute as it is humanly possible to attain in machine-shop practice is evident in the construction of this engine. Running balance, in an engine of over 500 hp. and turning up to and beyond 2,000 r.p.m. is also highly essential. Therefore, the most dependably accurate form of machining only—the grinding process—is trusted to do the work.

Notwithstanding the awkward shape of the parts, which do not lend themselves readily to grinding, but comparatively few and simple fixtures are needed. The inner part of the crankpin—that which is formed on the web of the short end of the shaft—is ground on centers as in Fig. 57, with a counterweighted plate to drive it. The longer end of the shaft requires a little more elaborate outfit to handle it when grinding the pin, since the weight of the shaft itself must be balanced.

The through hole in the inner part of the crankpin is fitted closely to the bolt *B*, Fig. 54—which enters in a direction opposite to its position shown in the illustration—and is tapped to correspond with the threaded end of the latter, which projects into the counterbored space at *C* and receives a locknut for additional security. It is this bolt that binds the two parts of the shaft together into a unit.

Cutting Splines

An indexing fixture, used on a Milwaukee milling machine, locates the long end of the crankshaft by its central bore to cut the splines by which the hub of the propeller is secured when the engine is put into service. An index plate of large diameter insures accurate spacing of the splines. This fixture may be seen in Fig. 58, with a crankshaft in place on the centers for the splining operation. Other shafts, before and after the operation, may be seen in front of the machine.

After the shaft has been otherwise finished it is put in static balance by means of the fixture shown in Fig. 59, and a circular weight, *A*, that is calculated to represent the necessary factor of the reciprocating weight of rods and pistons. The weight is split, and is clamped upon the pin by means of binding screws, so that it can be readily removed and replaced.

A ground plug wrung into the bore of the shaft at the short end rests upon a pair of anti-friction disks at one end of the fixture, while similar disks at the opposite end of the fixture take the weight of the shaft upon the shoulder that is to be the seat for the main roller bearing at the long end.

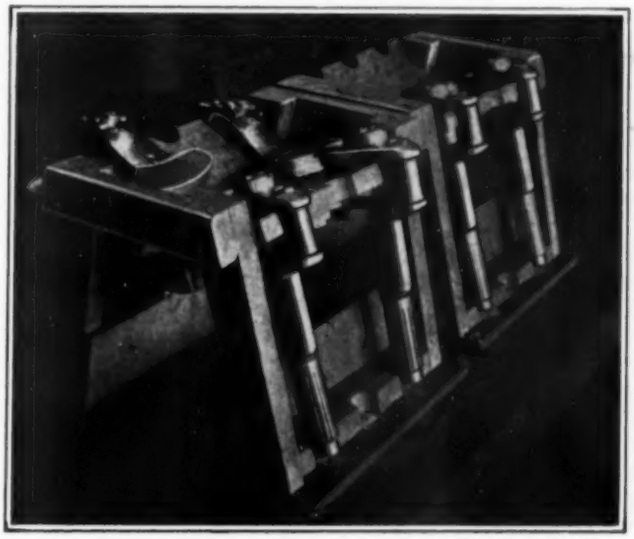


Fig. 61—A great deal of care is exercised to prevent damage to the finished and partly finished crankshafts while they are being transported around the factory. Wooden racks, each holding six crankshafts, are provided for the purpose

The balancing fixture is used on a bench that is adjacent to a lathe large enough to swing the shaft and cranks. Having determined approximately the amount and the direction the shaft is out of balance, the operator transfers it to the lathe where with a keen-pointed tool he may remove a sufficient amount of stock to restore the balance. This operation may have to be repeated several times, but an expert operator will balance a shaft very quickly. Fig. 60 shows the shaft in the lathe.

In moving the finished and nearly finished crankshafts around the shop, or from one operation to another as they near completion, the same care is taken to protect them from injury as is exercised in transporting the aluminum and duralumin sections of the crankcase. Wooden racks, as shown in Fig. 61, are provided to hold them, each rack holding six shafts in such position that the weight of a shaft prevents it from falling out of place, while the shape of the rack is such that its contents cannot come in contact with machinery or other metallic objects as the load is moved about by an elevating truck.

A Serial Number With a Meaning
Discussion

By W. J. Outcalt

ON PAGE 471, Vol. 67, of the *American Machinist*, Chester E. Josselyn suggests a remedy to overcome my criticism of Arthur A. Merry's method of machine numbering. Mr. Josselyn suggests the use of dashes following the month and year. There is an objection, however, to the use of dashes in a serial number, and trouble is apt to arise when the dealers or users order repair parts. They are very apt to omit the dashes. Then too, in telegraphing, the dashes necessitate extra words, adding to the cost of the message. A simple way to overcome my original objection is to place a zero in front of the single-digit months.

Reviving a Sick Industry

By James W. Hook
President and Treasurer, Geometric Tool Company

THIS is the story of the revival of a small New England metal-working concern that started many years ago and grew to vigor long before the World War began. Then, in the confusion of the times, it laid the foundation for serious depression, so that the company was not making money, and, therefore, not successful.

The new manager believed that the success of any business could be resolved into a simple formula, in which earnings equal sales volume less all expense. Profit always has a fixed minimum, represented by the smallest amount of money required to pay dividends and replenish surplus. Profits equal sales volume less expenses. Therefore, to increase profit, one must either increase sales, or decrease expense, or do both. By expense is meant both labor and material costs, as well as fixed expense. The ability to make each item of expense produce something worth while determines whether or not the presupposed success formula will be met. Sometimes, for example, in slicing expenses the selling price may be increased. When a business is sick, its trouble must be diagnosed and scientifically treated.

In the little business I am telling about, the new manager found, upon analysis, some ridiculous conditions prevailing. Not only did he find a sick business, but also a sick industry. He found a bad competitive situation, in which competitors were wasting their money. He found competitors attempting to carry every conceivable type of cutter in stock. He found that his own company had made 55,000 different kinds of cutters within a few years, 53,000 of which represented only 20 per cent of the sales volume. Of the 2,000 cutters that represented 80 per cent of the sales volume, he found that about 400 sizes represented 90 per cent. In other words, 400 sizes represented most of the sales volume, and the unit selling price, size for size, was the same on all the 55,000 sizes.

When this situation was submitted to all of the manufacturers, it was confirmed by the others. Then, the Division of Simplified Practice of the United States Department of Commerce co-operated with the industry in reducing the stock sizes to even less than 400, actually about 200, the remaining sizes being placed on a special non-stockable, extra-price basis that made them yield some profit. The effect of this move to the company was to reduce the total inventory to less than one-half of what it was, and permitting about four and one-half inventory turnovers per year instead of two. The money released was used to retire more than one-half of the company's outstanding preferred stock.

The company had maintained an elaborate perpetual inventory system on the 55,000 different items. It was maintained in order that the books of the company could be closed monthly, and the balance sheet prepared. And it was not used as a perpetual inventory should be used, namely, to show currently what the sales were of each kind and size of product. Today, the perpetual inventory enables the company to manufacture on a six weeks' basis. This means that the total finished inventory is turned over about every eleven weeks during the year.

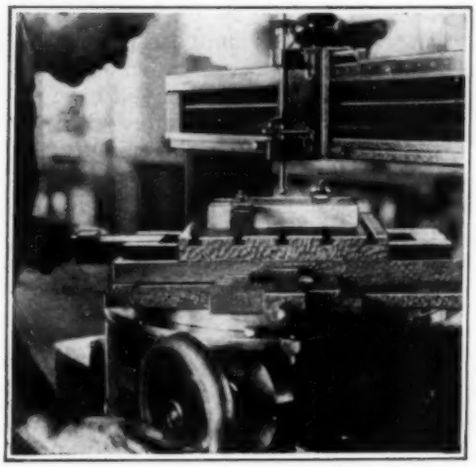
Another order that went into effect at the outset of the company's revival was for the ten-thousandth of an inch instead of a thousandth. In the plant it meant better machines, better jigs, tools, and fixtures, more and better inspection, better and more skillful workmen, and, most important and difficult of all, a different plant psychology. The word went around that no department would be denied equipment that, in the judgment of the engineering department, was necessary to meet the new and more stringent requirements. At the same time, every man knew that he had to sell the engineering department his reasons for asking for new equipment, and that new equipment, once ordered, must do the work or else reflect against the department head who requested it. The results of this policy were, of course, that old and worn out machinery, jigs, and tools were quickly passed into the discard, and new and up-to-date equipment installed in their places. Some of this new equipment so increased manufacturing efficiency, as well as accuracy, that in one case one new machine replaced six old ones, and in another case one machine replaced four others. It was amazing to the old employees of the plant to see how badly the new equipment was needed. The immediate result of installing new equipment was a reduction of almost 15 per cent in the number of men in the plant, and a large reduction in the manufacturing floor space needed. The floor space saved made it possible to put all of the manufacturing and inspection on one floor, and permit progressive manufacture throughout the plant.

Testing and Inspection

A new interest began to show itself throughout the plant when the new policies began to bring results. Ideas came from almost everyone, and the best improvements in jigs and fixtures were suggested by workmen and foremen. A testing laboratory was also established to test materials before accepting them. Every bar of steel that goes into the plant is now placed in quarantine, as the shop calls it, until an end can be sawed off and tested. If it passes the test, the bar is accepted. Vigilance in this direction, together with the new and more accurate equipment and the better feeling that grew out of it, has cut spoiled work by almost one-half. The immediate effect of demanding closer tolerances on work was to reduce man-hour output. But when the shop was able to meet the new limits of accuracy, piece work was installed at rates that were attractive, and the output per man went up.

A powerful sales campaign was also put in progress. New salesmen and service men were put into the field, and others into the shop for training. New tools were designed, and designs of old ones were improved. The result was that the company's sales increased substantially. It was recognized that nowadays a company cannot possibly remain up to date without good engineers, whose entire duties are to design and try new things, and watch the advance of the art all along the line. Today, the mental attitude of the whole organization is different, and it feels that it has accomplished results. The company now lays great stress on employee relationship. Its major move in this direction was to create a plan whereby any employee could own stock in the business. This was done by means of an employees' prior preferred stock, which regularly pays 7 per cent. It comes ahead of all other stocks of the company in the matter of dividends and assets in liquidation. The company offers to buy it at par on demand. Employees leaving the company for any cause, or desiring to sell the stock, are obligated to sell it back to the company at par, plus accrued dividends. This keeps the stock in the hands of employees.

Abstract of an address delivered at the New England Conference, Springfield, Mass., Nov. 18.



Measuring Machine Simplifies Laying Out of Dies and Gages

LAYING-OUT the contour of a blanking die for a part having an intricate shape is not altogether an easy task. Exceeding care, of course, must be taken in measuring and scribing the lines to avoid any inaccuracy, all of which is time consuming. Having a quantity of such work to handle, together with other similar layout operations, including those required in the construction of form gages and master plates, led the engineering department of the National Cash Register Co., Dayton, Ohio, to build a measuring instrument which, at this plant, is termed a laying-out machine. The machine is illustrated in Fig. 1. By its use the average laying-out time for the work mentioned has been cut to approximately one-third of that taken by former methods, with the added advantage of producing a more accurate layout.

The machine consists of a heavily-ribbed baseplate to which two upright brackets are connected. The brackets support a cross-rail to which is fitted a cross-slide and a spindle. A Pratt & Whitney precision rotary-table, also mounted on the baseplate, is equipped with a compound slide and table as shown. The entire unit is mounted on a sub-base, consisting of a cast-iron top supported on pipe legs, and rests on three-points, so that unequal stresses will be reduced to the minimum. In addition to this support, four leveling studs, located at the outer corners of the baseplate, are used to take up the outboard strain.

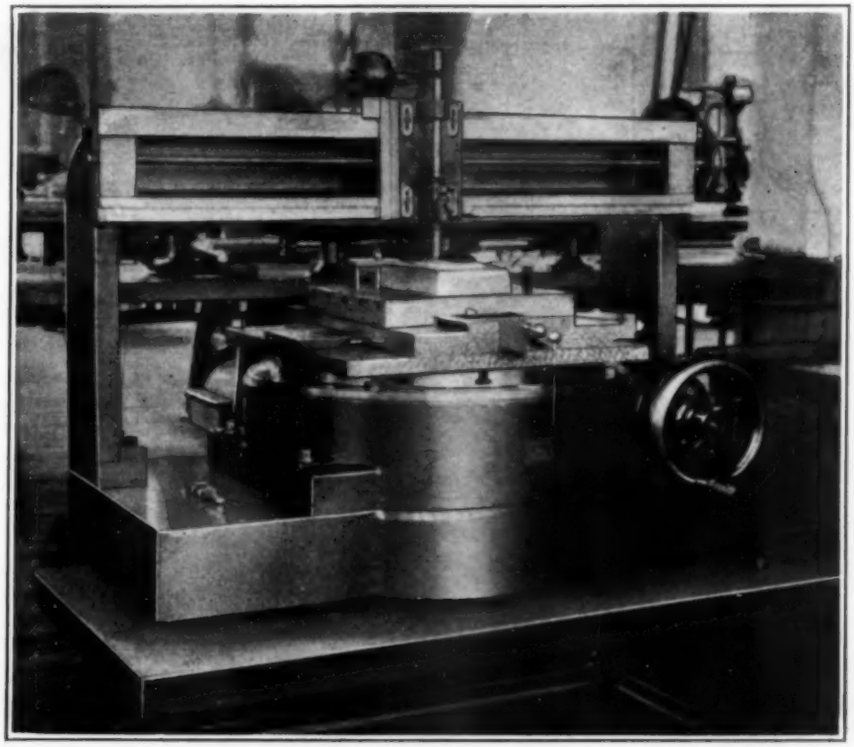
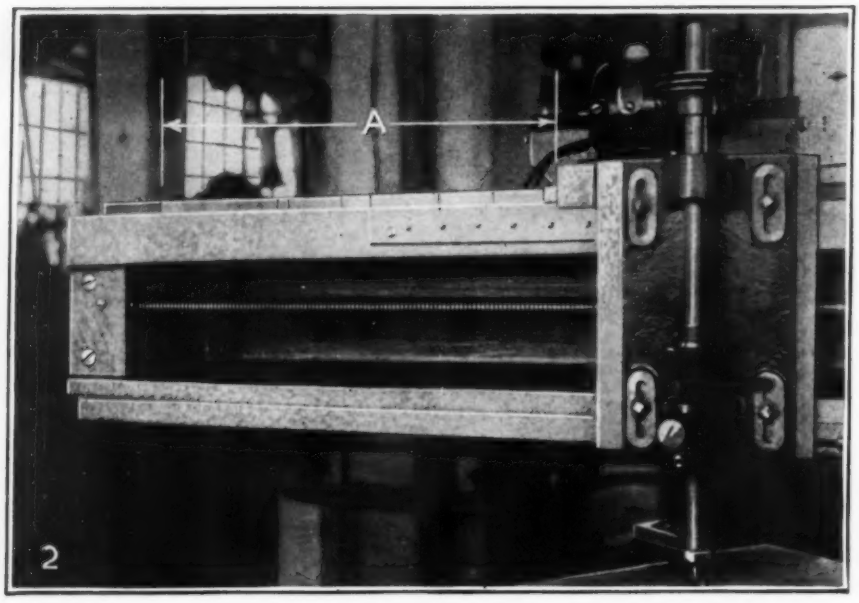


Fig. 1—Laying-out machine for dies, templets and work of irregular contour

The work to be laid out is clamped to the table, which is 12 in. square and has five T-slots to accommodate clamping bolts. As is the usual practice, the work is copper coated with a solution of copper sulphate. The first measurement made is to determine the center of the layout, which is checked usually from the blueprint of the part to be outlined, or from the tool drawing. The "dead" center of the machine is obtained by setting the slide on the cross-rail to zero, then adjusting the compound slides to similar readings obtained by the use of Johansson blocks. In Fig. 2 is shown at *A* a number of these blocks, equaling 12 in. in length, placed between the stationary set-edge of the cross-rail and the cross-slide, thus giving the zero reading. The same reading is obtained, however, by a vernier scale, of which the stationary member is embedded in the upper portion of the cross-rail, and the sliding jaw attached to the cross-slide. A set of blocks measuring 6 in. in length, is shown in Fig. 3 arranged for setting the compound slide to the "dead" center position. This measurement, likewise, can be made by graduations on the collar of the lead screw, after the approximate distance has been set by a scale. The spindle of the machine, measuring $\frac{7}{8}$ in. in diameter and operating in two bearings, is driven by a fractional-horsepower motor attached to the body of the cross-slide. A spindle speed of approximately 700 r.p.m. is maintained. The needle connected to the end of the spindle is $\frac{1}{8}$ in. in diameter, and is hardened and ground. The height of the needle in relation to the work is adjusted by raising or lowering the spindle, which is accomplished by merely resetting a collar next to the upper face of the lower bearing. The



needle is backed up by a spring, so that if the end pressure becomes excessive, as would occur in scribing an unevenly-faced surface, it will have an opportunity to recede rather than to "dig in" the work. This feature insures uniformity in the layout lines. If it becomes necessary to raise the needle after it has been set to a desired pressure on the work, such as in shifting it to a new starting point, it is necessary only to operate a lever attached to the lower spindle-bearing, which engages in a face cam located on the spindle. By throwing the lever from one side to the other, the needle clears the work by about $\frac{1}{8}$ in.; then when the motion is reversed, the needle engages the work at the same pressure as before. Thus in laying out the average work, one spindle setting only is required. The mark made by the needle is sharp and, to a certain extent, is engraved in the surface of the work. The point of the needle is conical and requires only stoning when dull. This operation is performed by holding a stone against the needle point at the proper angle as it rotates. Once a starting point has been determined, the contour desired is laid out by operating the various slides, either by using the graduations on the collars of the lead screws, or by the use of Johansson blocks, depending upon the accuracy desired. Radii and holes are marked by setting the slide on the crossrail off center a distance equal to the desired radius, then rotating the rotary table. A set-up for the laying out of a piercing die for the totalizing lever of a cash register is illustrated in Fig. 4. The work, shown standing, is an excellent example of what the machine can accomplish, in that it was made by dies laid out on the machine.

Fig. 2 — Distances on the cross-rail are controlled by Johansson blocks placed between a set-edge on the upper edge of the cross-rail and the sliding head.

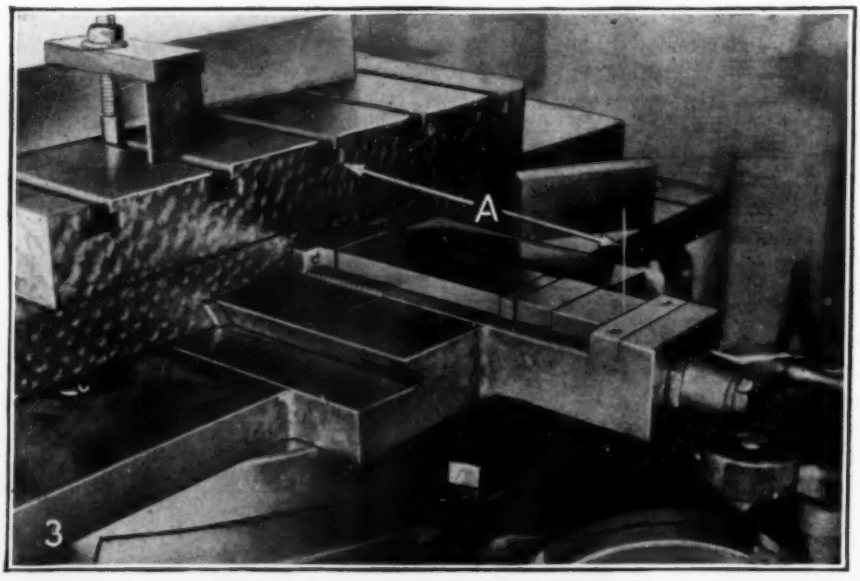
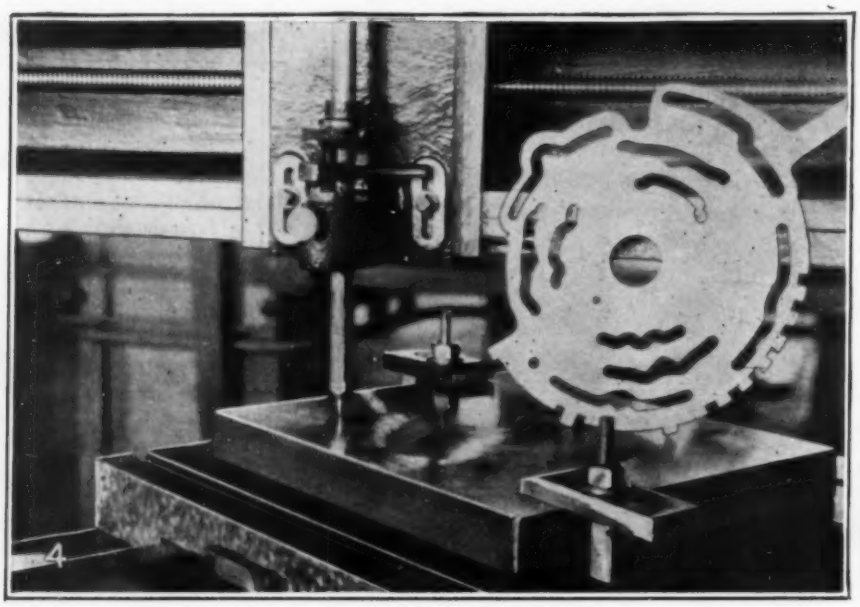


Fig. 3 — A set of Johansson blocks totaling 6 in. in length, arranged for the accurate setting of one of the compound slides.

Fig. 4—Set-up for laying out the dies for producing an intricate part for a cash register. The part to be seen standing on the compound slide was produced by several dies and is an excellent example of what can be accomplished



Shop Methods of the Delaware & Hudson Company

By Fred H. Colvin
Editor, American Machinist

The first of a series of articles showing some of the methods used at the Colonie Shops for handling a variety of work necessary in locomotive maintenance

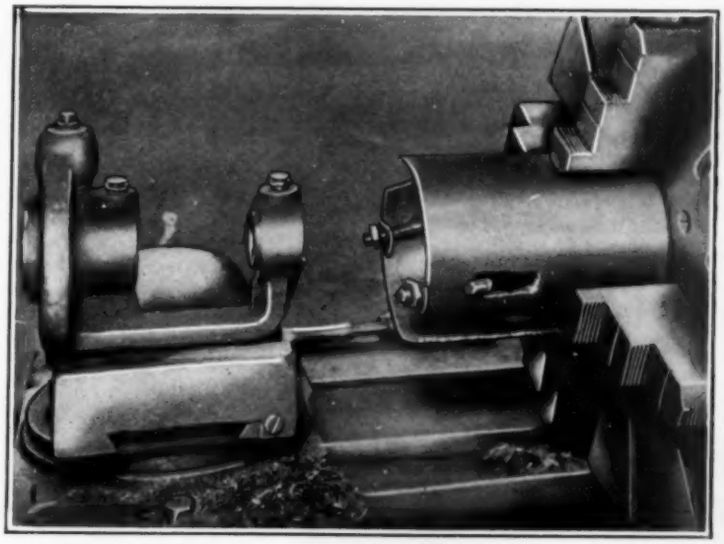
THE Delaware & Hudson Company was one of the first to use steam locomotives in this country, having imported the Stourbridge Lion from England away back in 1828, to be used in connection with hauling coal by the canal and inclined planes at Honesdale, Pa. Although primarily a coal road, it has always kept pace with locomotive development and is now running a very large and late development in locomotives, the John B. Jervis by name, that has a water-tube boiler and carries 400 lb. of steam.

This outline will give some idea of the work expected of the shops in keeping locomotives in repair in the shop at Colonie, a part of Watervliet, N. Y. While the management makes no pretense to startling innovations in either equipment or methods, there is much of interest in both, and work moves through the shop with ease and regularity. Some of the methods are of special interest because of their simplicity.

Several lathe jobs are shown in Figs. 1 to 6, where throttle stuffing-box glands, tank valves and safety-valve chambers are being turned and bored. A stuffing-box gland and the chuck used for holding it are shown in Fig. 1, the piece being an awkward shape to hold. The chuck consists mainly of a large piece of tubing, bored at the outer end to receive and center the flange on the stuffing-box gland, and cut away with a torch at various places to allow room for ribs and other projections. Fig. 2 shows the gland in place and explains the reason for the long opening at the side of the chuck. The gland is held by the two hook bolts that draw it tight against the chuck. The machining is simple after the piece has been chucked. This method of making special holding devices is inexpensive and they can be made quickly.

Another awkwardly shaped piece is shown in Figs. 3 and 4. The only special equipment for holding it is the piece *A* fastened to the chuck so as to locate the offsets on the end when the valve is held at an angle to bore the side outlet, as in Fig. 4. The chuck jaw fits inside the opening in the end and the flange on the end is held by the central projection of *A*. This method of chucking has the advantage of being very simple and can be adapted to many different kinds of work. A study of the

The first article. The second will appear in an early issue.



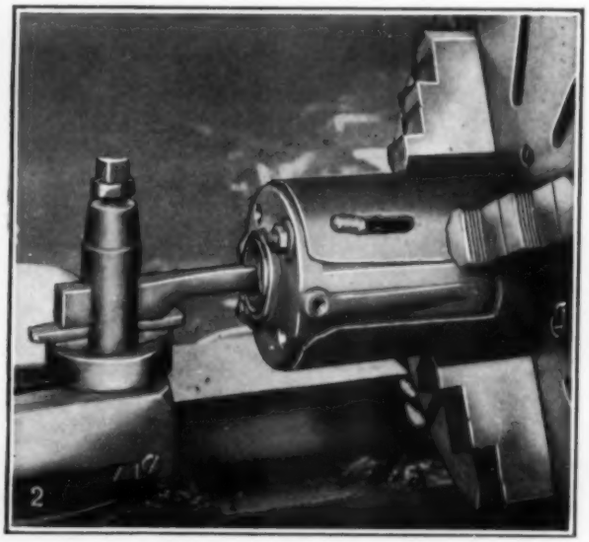


Fig. 1—Stuffing-box gland and chuck for holding it. The chuck is made from a large tube having the end bored to receive and center the flange, and has portions cut out with a torch to accommodate projections on the gland. Fig. 2—Boring the gland. This view shows the need for the cut away portions of the fixture, and also how the gland is held by hook bolts fitting through the holes in the flange. The hooks go in the slots shown

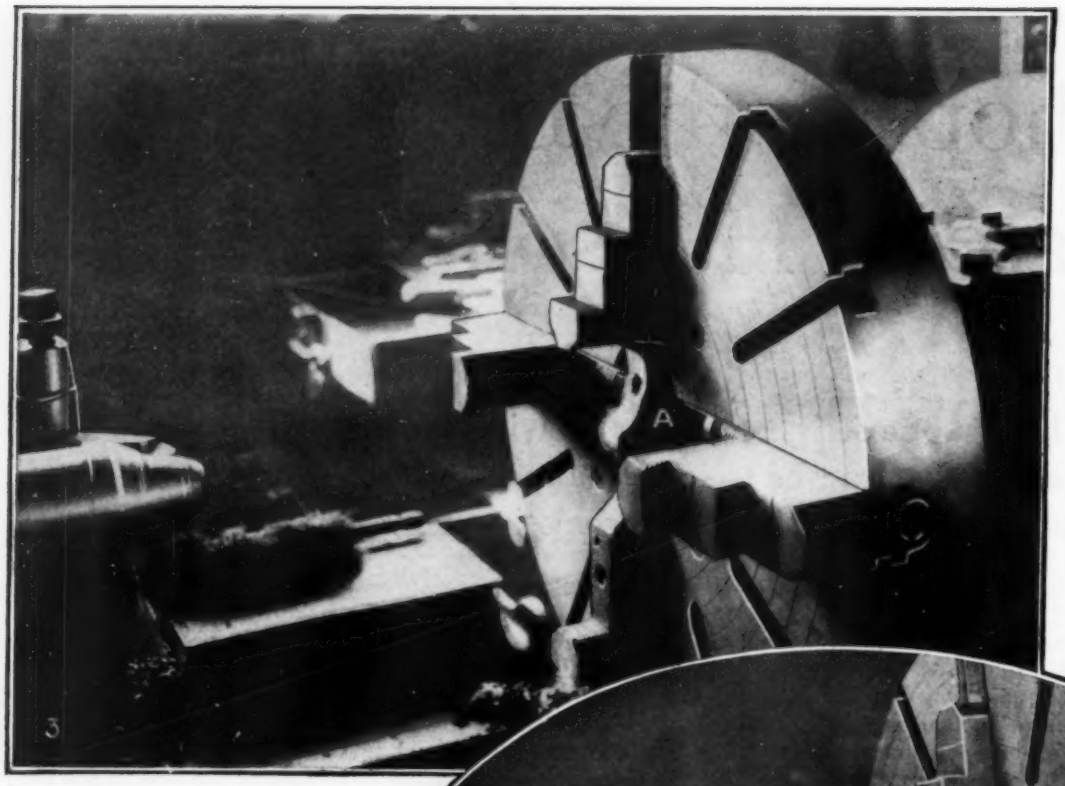


Fig. 3—Chuck equipped with special center piece to locate and hold odd-shaped work and at an angle. The central projection acts as an abutment for jaws to hold work against. Using this abutment to hold the collar of the casting and properly positioning the jaws the awkward shaped piece is readily and firmly held with the dead center in position as shown in Fig. 4

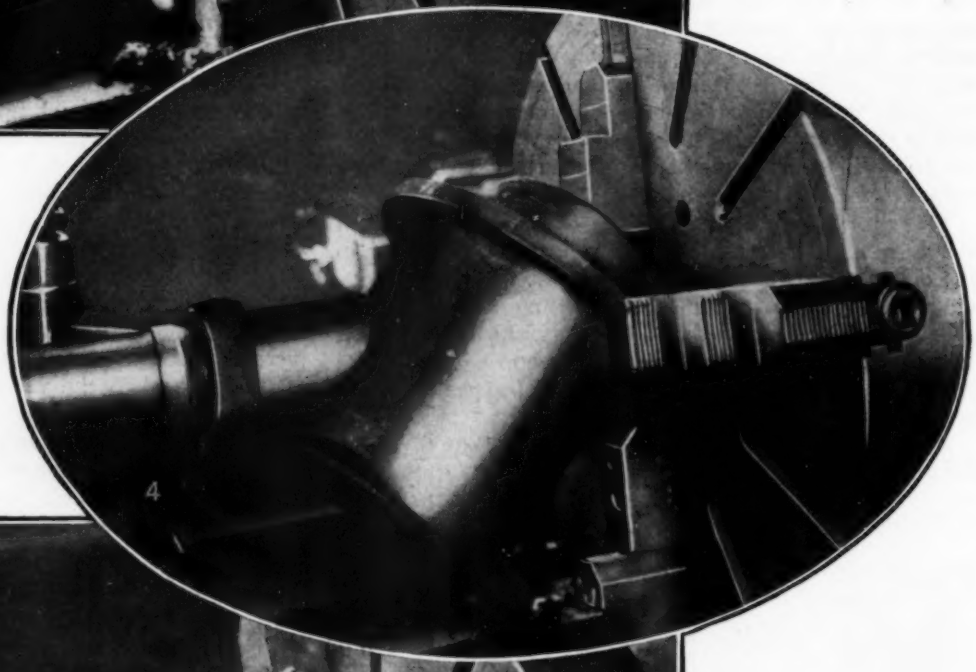


Fig. 4—Tank valve held on the center piece for boring of the angular opening. This method permits the use of a standard chuck for much special work

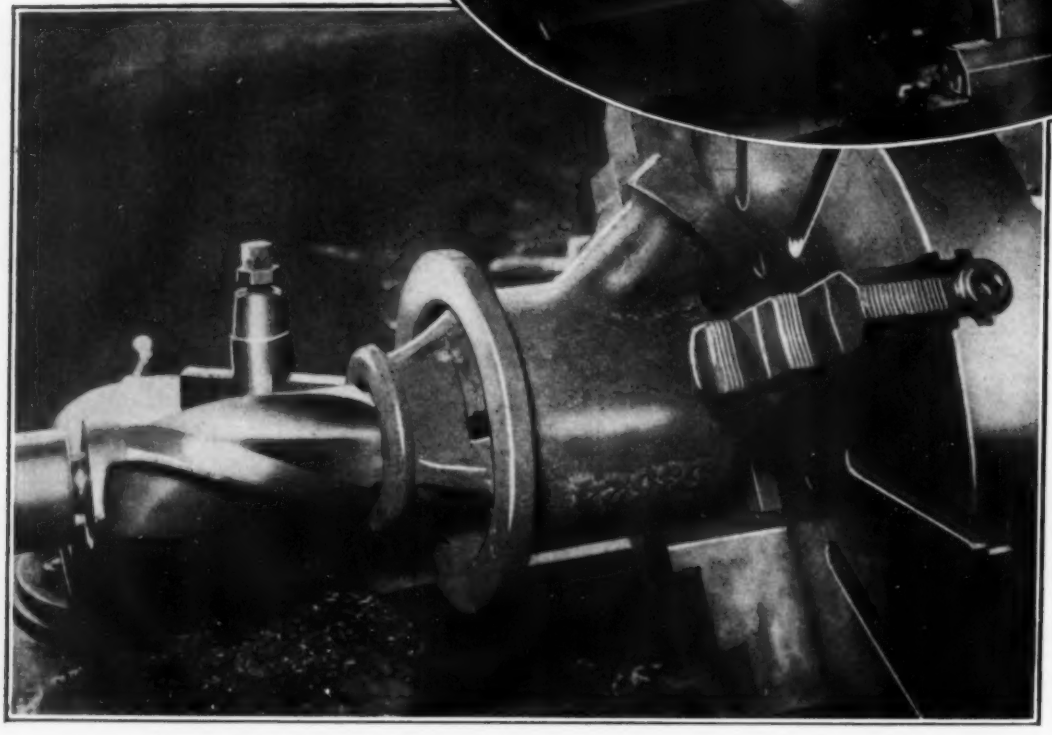


Fig. 5—Boring and facing the other end of tank valve casting. Here the center piece is removed and the chuck is used in the regular manner. The large hole is being bored with a three-lipped drill. It is only necessary to so locate the jaws as to center the casting on the first piece

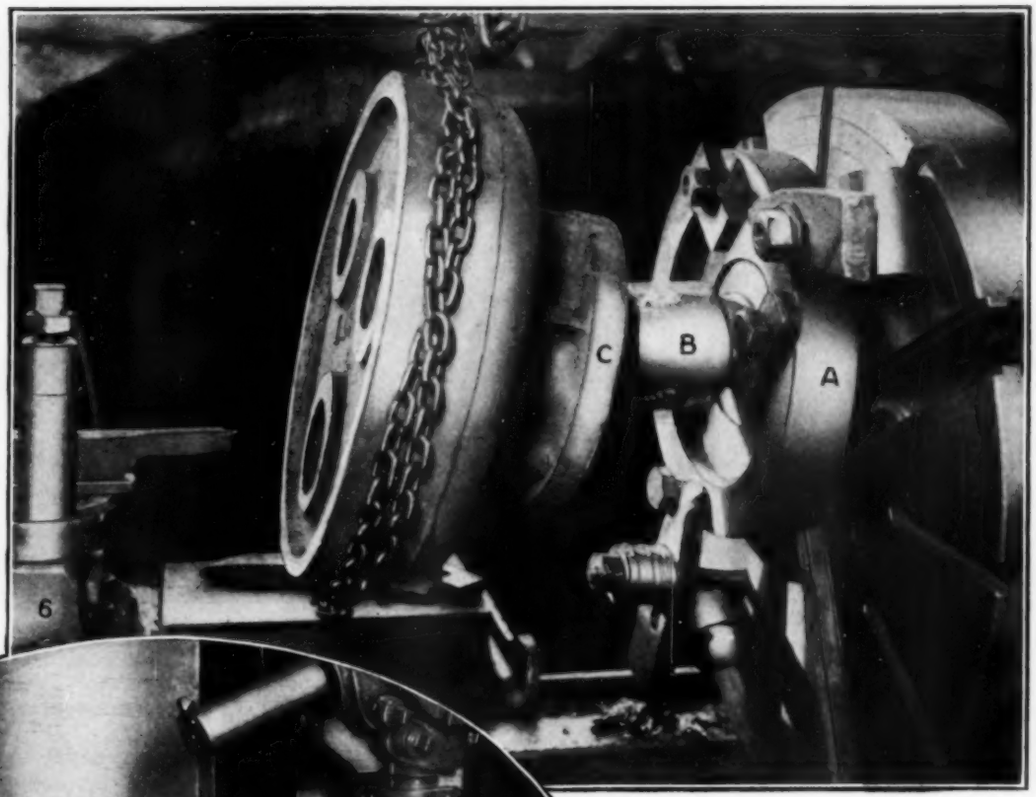


Fig. 6 — Boring three openings in the safety-valve chamber in an auxiliary chuck bolted to face of regular chuck. The offset permits one hole after the other to be swung into line and bored. The plate A carries plug B which makes it easy to place the work in position as it is handled by the chain hoist. Collar C fits in the recess in A

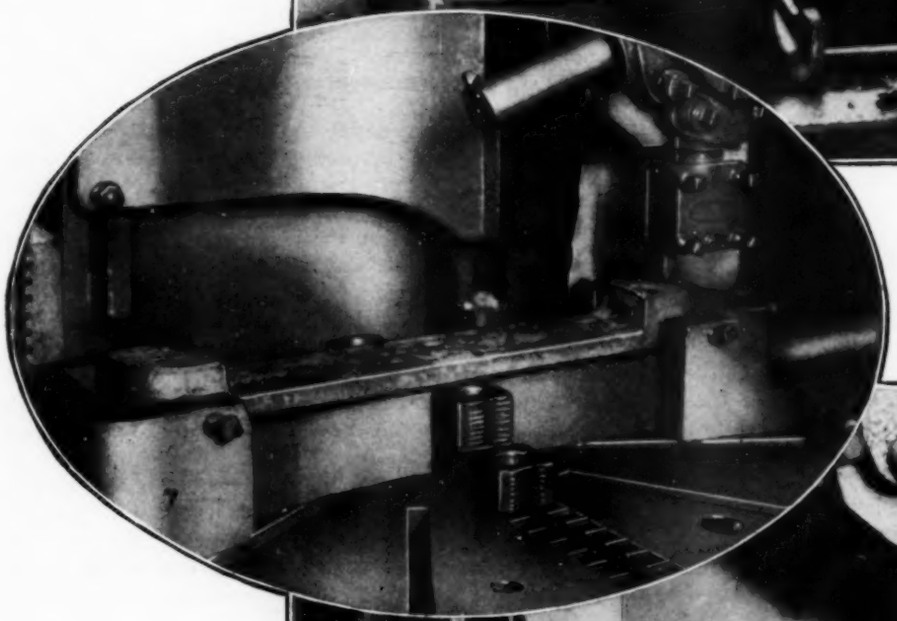


Fig. 7—Facing ends of a link saddle on a boring mill. The saddle is held in a special fixture and both ends are faced at one setting

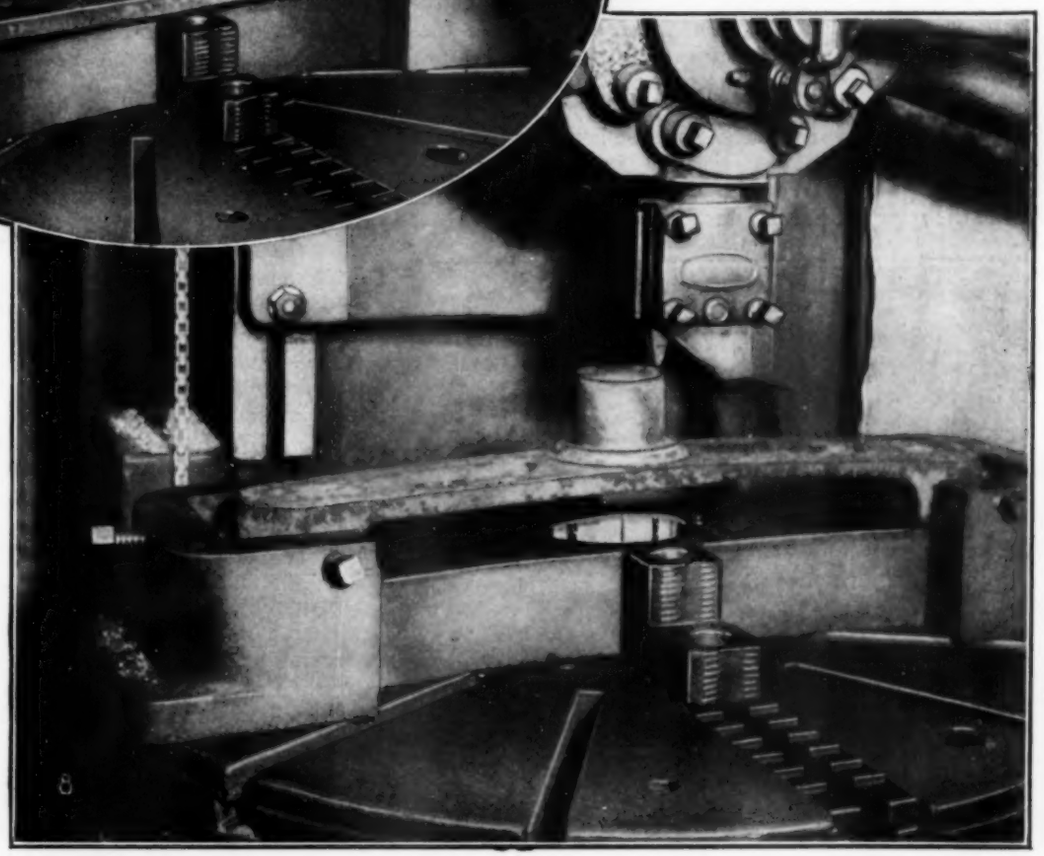
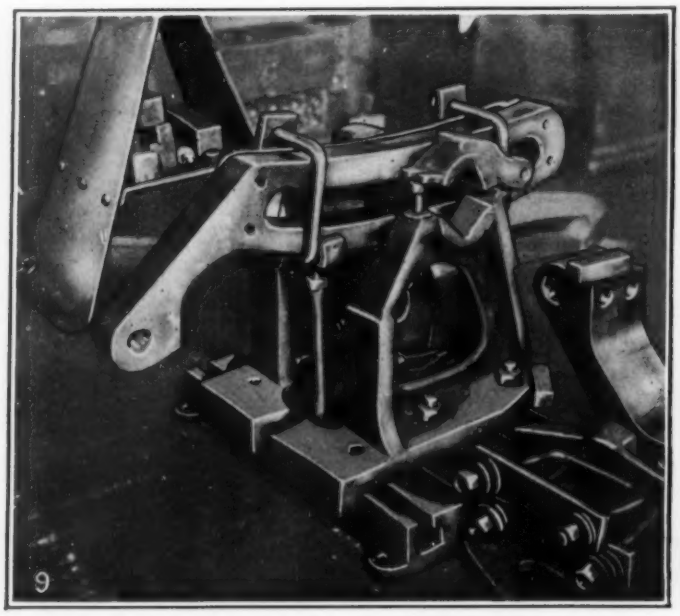


Fig. 8 — Facing and turning the trunnion on the link saddle. The same fixture answers for both sides, the recess in the center holding the trunnion in the first operation. This is a very simple and convenient chuck and one that is easily adjusted. It is held in position by the jaws of the chuck that forms part of the boring mill table



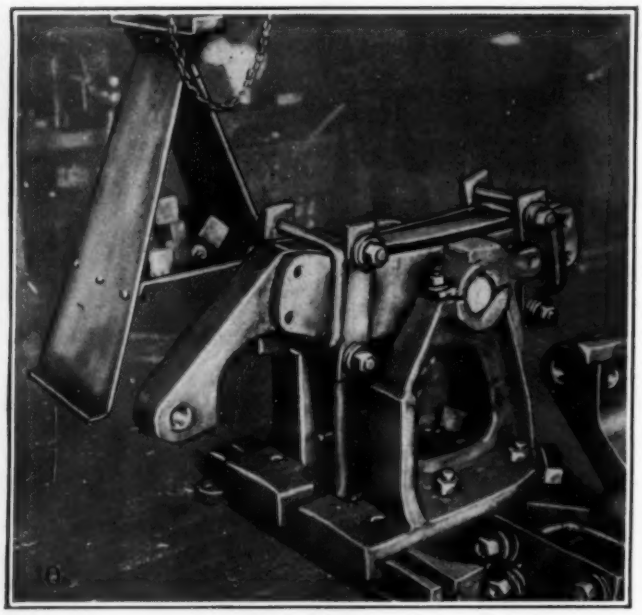


Fig. 9—Fixture for locating the link saddle in proper position on the link, before drilling the four bolt holes. After clamping the saddle it is drilled by using the holes in the link as drill bushings. Fig. 10—Same fixture with the other side of the saddle in place. Each side is clamped with separate U-bolts. After both sides have been located, the last side of the saddle is drilled through holes previously drilled in the first side

piece to be held and a little ingenuity enables many awkward pieces to be held in a similar manner.

For boring the other end, the locating piece is removed from the chuck and the body is held by the jaws in the regular manner, Fig. 5. As shown, the end is being bored with a large three-lipped drill and the flange is being faced by the tool in the tool post.

The safety-valve chamber of a large locomotive is not an easy job to machine. The chambers used on a number of the D. & H. locomotives have three openings that must be bored in their proper positions. One of these castings is shown in Fig. 6 and also the chuck in which it is held. With the jaws removed from a chuck of suitable size, the adapter *A* is clamped to the face in a position that will bring the holes to be bored at the center of the chuck.

Pilot *B* guides the casting from a hole in the center, while the recess in the adapter *A* fits the flange *C* and aids in holding the casting firmly when clamped by the short straps shown. With the casting mounted in the chuck it is necessary only to turn the work from one hole to the next in order to bore all three at one setting. While there are not enough of these chambers to warrant a permanent fixture, this device saves time and secures uniformity in the work.

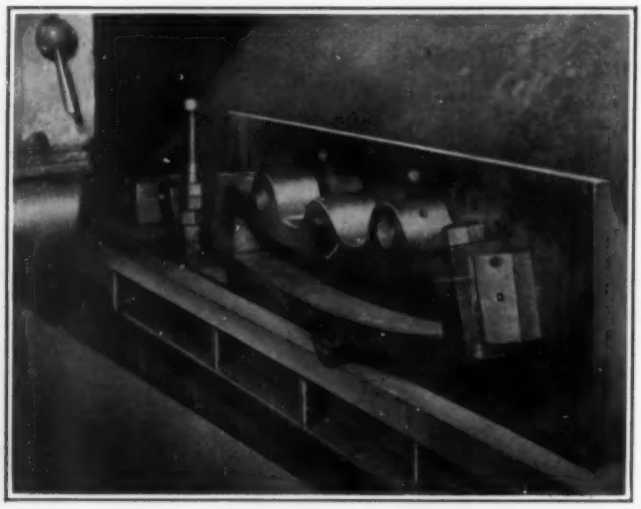


Fig. 11—Grinding side of link on special holding device. Link hangs on pins entering eccentric-rod pin holes and is held endwise by wedges between the ends and the blocks on face of fixture

Link saddles are faced and the trunnions are turned on a vertical turret lathe as in Figs. 7 and 8. The saddles are held in a special fixture which has a recess for the trunnion and three setscrews at each end for locating and holding the ends in the correct position. Fig. 7 shows the ends being faced.

Reversing the saddle as in Fig. 8, the ends rest on the surfaces that have already been faced, and the trunnion in the center is both faced and turned by the tools in the turret. This view also shows the recess in the center of the fixture for clearing the trunnion when the saddle is in the reverse position.

The links are machined and the four bolt holes are drilled, after which they are case-hardened. The holes already drilled act as a jig for drilling the holes in the saddles. One saddle is clamped in place, as in Fig. 9, the positioning being done in the fixture shown. After the correct position has been determined, the link and saddle are removed from the fixture and the holes are drilled, using the holes in the hardened link as a guide. Then the second saddle is positioned, as in Fig. 10, clamped by a second set of U-bolt clamps, and the holes are drilled, using the previously drilled holes as guides. This method and fixture have proved very useful in securing the proper positioning of the saddle trunnions with regard to the center line of the link, and thereby securing a greater uniformity in valve action.

Links are ground after hardening, both on the sides and inside where the link block travels. A fixture for holding a Stephenson link for side grinding is shown in Fig. 11. Here the link is held on suitable pins that fit into the eccentric-rod pin holes, while the link is held against end movement by wedges driven between its ends and the blocks fixed on the angle plate.

Abstracts of A.S.M.E. Papers

The following are abstracts of some of the papers to be presented at the annual meeting of the American Society of Mechanical Engineers, to be held in New York, December 5 to 8

Symposium on Hydraulic Feeds for Machine Tools

Characteristics of Hydraulic Feed and Drive for Cutting Tools

By Walter Ferris

Vice-President and Chief Engineer, The Oilgear Company

DURING the past five years, considerable progress has been made in the application of hydraulic methods to machine tool operation. The new hydraulic devices are driven by definite volumes of liquid delivered from the pump to the operating cylinder. The pressure is low if the piston encounters no resistance, and the distance moved by the piston corresponds to the discharge of the pump, whether the resistance be high or low. The following list of general properties of these mechanisms may be helpful in determining their practicability:

(a) High efficiency.

(b) Speed control. As applied to feeds, it permits the operator without stopping the machine to select at any moment the maximum speed which the working tools will stand.

(c) Lower cutting force. The power saving is of no importance commercially, but the fact may be of great significance in investigating the action of cutting tools.

(d) Adaptability to control of inertia forces. The gradual change of speed due to the progressive stroke changes in the driving pump is of great advantage in handling heavy masses such as large grinder tables, which must be frequently reversed. In some applications closed circuits are employed in which the kinetic energy of reversal is transmitted through the pump to the driving motor. Another method is to use a constant-displacement, low-pressure pump and motor, absorbing the energy of reversal by expelling part of the oil in the circuit through regulated orifices.

(e) Flexibility of design conditions. When designing hydraulic feeds, it is not necessary to accurately specify the rate of feed required. This can be determined experimentally when the machine is operating.

(f) Standard units. Nearly all hydraulic feeding units use one or another of a series of standardized pumps with the appropriate standardized cylinder or rotary motor.

(g) Adaptability for operating auxiliary devices. Many of the standard feeding pumps available include in their construction a low-pressure gear pump. With such pumps, connections may be taken out from the circuit to operate auxiliary clamping devices for holding work, for shifting clutches or gears, or for any other desired function.

Every hydraulic transmission consists of a driving pump and a driven motor. The motor may be a reciprocating cylinder, or it may be a rotary motor. The rotary motor comprises the same running parts that are used in the corresponding pump, usually omitting the variable stroke. In the general case of spindle drives, however, variable-stroke motors will become almost as essential as variable-stroke pumps, because only when the pump is running at its full capacity will a constant horsepower input be maintained. To have complete individual speed control of two or more hydraulic motors, each motor must be driven by its own pump and the entire flow from the pump must go through that motor. If the speed control required on two cylinders is simultaneous and proportional, the two cylinders may be placed in series in a closed circuit with a single pump. The travel of each is usually co-ordinated mechanically by racks and pinions or by linkage, but the hydraulic method alone is more flexible and safer.

It is sometimes better to use a multiple transmitter consisting of one double-acting cylinder reciprocated by the pump and operating several cylinders whose piston rods are attached to a single crosshead. Each of these secondary cylinders acts as a pump or impeller for its own individual driven or feeding cylinder.

In the application of hydraulic feed as compared with geared feeds, there are several essential peculiarities that should be taken into account. In the first place, there is always a certain amount of leakage in the pump and this leakage is greater as the cut gets heavier and the oil pressure rises. This is known as the "slip." The flow of oil actually delivered by the pump into the feeding cylinder is less as the resistance increases. Hence, when the tool takes an extra-heavy cut, the feed will automatically slow down until normal conditions are resumed. Follow-up, as it is called is caused by the elasticity of the oil column and the cylinders and conduits that contain it. The amplitude is small and the action is practically frictionless. The effect seems to be to soften or cushion the peaks of the feeding force applied to the tool.

Vibration in the column of pressure liquid is caused by a rapid succession of impulses from the pump plungers. These pressure impulses are very evident at high pressures and hence for certain work, such as grinding, the working pressures must be kept low enough to avoid perceptible vibration that may mark the work. With hydraulic feeds there is also present the ability to stall against an obstruction, thus protecting the parts against breakage and at the same time providing an ideal method of locating shoulders, and facing to length.

The pressure gage on either a feeding or a driving circuit gives important control over the operations. Dulling of tools is clearly indicated before breakdown of the machine occurs. Various protective governing devices may also be operated by the pressure in the circuit. The most significant advantage of hydraulic over mechanical feeds, however, is their indifference to heavy work. A hydraulic outfit will deliver its maximum speed and force for a long period without strain or perceptible wear.

The Development of Hydraulic Feeds on Multiple Drilling Machines

By R. M. Galloway
The National Automatic Tool Company

THE National Automatic Tool Company started experiments about six years ago with the idea of adapting hydraulic feeds to multiple-spindle drilling machines. One of the first machines designed employed an Oilgear automatic pump. The mechanical part of the control was arranged so that the operator could set the feeding mechanism to perform any one of its functions; that is, rapid approach, slow advance at either of the two rates of feed, rapid return, and stop. The distance of travel at the different rates of feed was controlled by the position of dogs adjustably mounted on the column of the machine. The machine was constructed unusually heavy and rigid to stand the added load of the hydraulic feed and to reduce vibration. It proved entirely satisfactory.

The success of this machine led to the development of still smaller machines on which it was desirable, if possible, to use a less expensive pump. After a careful investigation, it was decided to experiment with a gear pump. The control of the feed on a machine equipped with a constant-pressure, constant-flow pump was very simple. A slide valve was arranged so that the straight-line motion of the slide connected a supply port with various other ports in turn as the motion progressed. At the same time other ports were connected to a drain line. The valve was operated through a "load-and-fire" device.

Up to 1925, special two, three- or four-way drilling machines were very expensive to build because they were usually designed new throughout for each job. Hence, in developing the hydraulic way drilling machines, it was decided to so design a self-contained unit that it could be used, mounted in various positions, to form a way machine composed of one or more self-contained units arranged on a base or column, or some combination of these. It was important that several units should be operated from one supply pump in order to simplify the machine and keep the cost low. Experiments showed that several cylinders could be operated simultaneously by oil supplied by a single gear pump and, if sufficient oil was being pumped at all times so that there was always a slight amount being bypassed through the relief valve, the rate of movement of any cylinder could be changed without any material change in the rate of travel at the other.

The unit proper remained stationary, and the spindle was traversed to the work, fed through it and returned to its stopping position by the thrust of the piston rod. A motor was mounted on the unit above the cylinder for rotating the spindle. A slide valve, operated by a load and fire mechanism was mounted on the side of the unit for controlling the feed cylinder.

These units were built up into special machines having from two to seven units. One reservoir and one pump were assembled in each machine. All units were standard and were started from a single air valve mounted in a convenient position. All the units in one of these special machines would start simultaneously and each had its own length of rapid traverse forward and each had its own rate of feed in inches per minute. Such arrangement made it possible to handle a great variety of work on one machine.

Later, machines were built with a traveling head unit mounted on the ways instead of a traveling spindle unit. The units are produced in quantity and carried in stock together with several sizes of pumps and tanks. To build a special machine it is only necessary to build specially the spindle, cluster boxes, and mounting frame. The remainder of the machine is standard.

Hydraulic Feeding Mechanism for Milling Machines

By Sol Einstein and Hans Ernst
Cincinnati Milling Machine Company

IN THE application of hydraulics to the reciprocation of a milling machine table, the following operating characteristics must be provided:

Reciprocation in either direction at normal feeding rates or at rapid traverse rate, together with positive control of the feeding movement regardless of the direction or amount of the resulting cutting force. It should be possible to lock the table in position so that it is incapable of movement under the action of the cutter. Accurate reversal should also be provided under any cutting condition, together with a readily controlled acceleration or deceleration of the feed rate during the cut. Economical operation is also presupposed. The above operating characteristics have been obtained in the Cincinnati Milling Machine Company's "Giant Hydromatic" by the use of a special combination of pumps and auxiliary devices. The forward pressure is automatically adjusted to meet the various operating conditions by the use of a special differential control valve.

In the article the authors develop fully the principle of hydraulic control and operation and then proced to show its practical application to the machine mentioned above. The hydraulic part of this apparatus consists of a rotor and pendulum of a standard Oilgear pump, a small booster pump of simple construction, a high-grade gear pump, and the necessary control valves. Interconnection is made chiefly by drilled holes in the various parts. All the operating characteristics enumerated above have been met in this machine.

One of the most outstanding characteristics noted has been an exceptional increase in the life of the tools. This is partly explained by the fact that there is a certain amount of yield in the oil system whereby peak loads that occur in the formation of a chip are reduced as well as the impact caused by the teeth coming into action. Tests show that a hydraulically-operated table does not move at a constant rate, but definitely yields a measurable amount under each successive tooth impact and for each revolution of the cutter due to slight eccentricity. Tests also show a substantially higher efficiency of meta' removed per horsepower by the use of the hydraulic feed.

Another advantage is the fact that the entire feeding mechanism is automatically safeguarded against overloading by the action of the various relief and control valves.

Hydraulics and Modern Machine Tool Design

WALDO J. GUILD
Chief Engineer, The Heald Machine Company

AFTER showing that incompressible liquids have advantages over air for machine-tool drive and operation, the author shows how the pressure and volume of the pumping unit are determined by the energy required by the device in a unit time. He then passes on to a study of the control devices for regulating the volume of fluid delivered to the driven unit by the throttle valve and bypass valve. In discussing applications of hydraulics to several types of machine tools, he concentrates on grinding machines.

Internal grinding machine tables are being reciprocated at high speed with practically no shock at reversals. This is accomplished by using a double-acting cylinder unit to drive the table in either direction, controlled for reversing by a four-way valve. Various types of valves are used, but in all cases this valve is operated by dogs on the table, adjustable for various lengths of stroke and relative position of stroke to other units. To obtain reversals at high speed, oil dashpots are generally employed in the reversing mechanism to impede its action. However, the use of a relief valve on the main oil supply automatically prevents the rapidly moving table from being at any time imposed against an incompressible body of oil in a closed chamber.

Air must be kept out of the oil system to insure smooth motion. This necessitates tight joints in the pipe lines, especially on the suction side of the pumping unit. Some air, however, will be picked up by the oil and must be allowed to escape by opening pet cocks at the highest points in the system. Sharp turns in the pipe lines should be avoided to reduce friction. Eddy pockets should also be avoided as these tend to separate the air which the oil may be carrying in solution.

By the use of suitable throttle valves and bypass valves, four changes of table speeds are employed during the grinding of one work piece: a rough grinding speed, a wheel-dressing speed, a finish-grinding speed, and a fast speed for separation of wheel and work to allow room for chucking. In some kinds of grinding machines, oil pressure is used to obtain feed of the wheel to the work, either by increments or continuously during the grinding operation. Wheels are rapidly advanced to and withdrawn from grinding position, as in the grinding of crankshafts. These crankshafts are also being clamped by hydraulic pressure. Wheels are also being carried across the work surface at slow speed in one direction and retracted in the opposite direction at high speed by interposing a modified check valve.

Symposium on Shop-Equipment Maintenance

FOUR of the papers composing the following symposium describe the organization of the department in the charge of which this feature of the manufacturing problem is placed by four large American industrial concerns. In the first paper, entitled "Plant Maintenance," Geo. H. Ashman of the General Electric Co. describes in detail how maintenance work is taken care of in each department. The organization and methods of ordering and making repairs, and the accounting practice in connection with them, are all discussed. Safety work is also included.

Similar treatment of these problems is given by J. R. Weaver, assistant superintendent, equipment department, Westinghouse Electric & Manufacturing Company, in a paper entitled "Maintenance of Shop Equipment." The system employed by this company in its East Pittsburgh plant makes use of tool supervisors and machine tool demonstrators, who are specialists in specific kinds of machine tools. The author indicates that considerable assistance has been given machine tool builders by pointing out chronic defects in their equipment.

Maintenance of machine equipment at the National Cash Register Company's plant is described by William Hartman in a paper by that title. The chief characteristic of this work is that there is no budgeting of repairs in this plant, because, due to the closeness of the work, the machinery must be kept in perfect condition. It is felt that a budget would hold back needed repairs. Certain classes of equipment receive special monthly inspections by experts. In all cases, cause of wear or other weakness is carefully investigated so as to reduce further trouble. A thorough inspection is given all equipment during the annual two weeks' vacation period.

In the fourth article by C. S. Gotwals, the maintenance of shop equipment at the Hess-Bright Manufacturing Co. is discussed. In this plant repair expenses are budgeted and repairs are made when convenient, except in cases of emergency. The amount of money allowable for repairs is a function of the productive labor. Lubrication is given special attention in this plant. In the case of large machine tools lubrication is placed under the supervision of the maintenance engineer. Particular attention is given to providing only clean, filtered oil to all journals in order to reduce wear. The author also indicates that when the cost of repairs to any machine per year approaches 20 per cent of the cost of a new machine, new equipment is considered. If the saving in labor, plus the saving in repair expense will pay for the new equipment in two years, it is considered a sound investment.

The fifth paper, by W. H. Chapman is entitled "Plant Maintenance and Return on Capital Investment." This paper is more directly related to the fundamental economics of the question of plant maintenance. After defining plant maintenance as he understands it, the author lists twelve items of equipment to be maintained which he later discusses in detail. He attacks the problem from the point of view of accounting practice in the distribution of maintenance expense and its effect upon invested capital, and after laying down some general principles, proceeds to apply the principles to the study of the twelve items previously enumerated, showing how the expense involved in each should be distributed. He also discusses the set-up of the personnel organization and the maintenance department and the physical layout necessary to maintain equipment. Finally, in a summary he returns to the economic phases of the subject and shows by an example how the proper accounting of expenses will affect the return on investment. He indicates that where alterations to machines have been made to improve operating conditions the expense should not be charged against repair orders, but rather to new capital.

Symposium on Lubrication

An Investigation of the Performance of Waste-Packed Armature Bearings

By G. B. Karelitz
Research Department,
Westinghouse Electric & Manufacturing Company

IN WASTE-PACKED bearings, the flow of oil through the shell is very small and the journal and shell are therefore in contact. Boundary lubrication exists in the contact area, however. Since there is radial clearance and since the oil film has a wedge shape, hydrostatic pressure is created, carrying part of the load. Naturally, friction is considerably higher under conditions of boundary lubrication than in a load-carrying oil film. It is therefore essential that the oil film should not be destroyed.

When properly operating, the clearance of the bearing is fairly full of oil. The slight vacuum created on the unloaded side of the bearing holds the oil in the clearance and very little actually leaks out of the bearing. This vacuum zone is the most vulnerable area of the oil film. It is therefore important that the window should be reasonably sealed with oil-saturated waste.

The waste used in motor bearings should be of long-fiber wool or a mixture of wool and cotton. A degree of resilience in the packing is required in order that it will not be shaken down from the journal by the jarring of the car on the track. Cotton, because it has no resilience, is not suitable for packing bearings. The window must be completely filled with waste. A skein of long, straight strands should be introduced into the waste chamber, extending to the bottom and spread over the whole width of the window. Balls of waste of medium size should then be packed behind it to form a resilient cushion. The packing should be as tight as possible from top to bottom. When the packing is carefully made and properly lubricated, waste may remain in the bearing for very long periods of time without injury.

One of the causes of oil-film rupture is excessive "oil lift," that is, when the oil level in the oil chamber is too low.

The oil to be used for railway armature bearings must have both high viscosity and good oiliness. In straight mineral oils, oiliness is obtained by using high fractions or a filler, such as soap. Oils of both types have proved to give good service. The straight mineral oils have generally a higher viscosity due to the content of high fractions. In an ideal waste-packed bearing the supply of oil through the wick should be regulated so that it would just compensate the slow loss of oil from the clearance due to leakage and evaporation. This ideal condition is not obtainable, however, because the ability of the wick to deliver oil is affected by both the oil lift and the temperature. Devices have been placed on the market for maintaining a constant oil lift. These have proved satisfactory.

The temperature of the oil in the bearing is the most important factor in defining oil flow. The viscosity of the oil decreases greatly with increase in temperature, while the surface tension remains fairly constant, and the rate of flow is inversely proportional to the viscosity of the oil. One of the most unfavorable features of waste lubrication, therefore, is the fact that very little oil is supplied to the journal until the bearing is fairly warm and the viscosity of the oil in the well drops sufficiently. During the warming-up period the bearing must rely for its lubrication on the residual oil held in the clearance by capillary action when the motor is not running. It is the author's opinion that most of the bearing failures occur during this period of faulty lubrication.

The presence or absence of grooves does not affect the performance of the shell so far as the bearing proper is concerned but they do assist in conveying oil to the thrust collar-flange when thrust is applied. A groove extending from the bottom of the window diagonally toward the collar, therefore, may be useful. The chief supply of oil to the flange occurs after stopping the journal.

The Effect of Running In on Journal-Bearing Performance

By S. A. McKee
Assistant Mechanical Engineer, Bureau of Standards

A FEATURE recognized by the operators of machines containing journal bearings is that a certain amount of "running in" is necessary before the bearing behaves in a normal manner. One reason for this procedure is that even with the best of finishing processes, the surfaces are relatively rough and irregular compared to the thickness of the oil film between them. The high spots on the journal strike those on the bearing and cause local breakdown of the oil film. Running in reduces these high spots either by a tearing action or by cold working.

Tests were made to determine the variation in the frictional resistance of a typical set of bearings under different degrees of running in. From the results the coefficient of friction f was plotted against the generalized operating variable ZN/P, where Z is the viscosity in centipoises, N the r.p.m. of the journal, and P the load in pounds per unit of projected bearing area. The curve for a typical bearing is practically a straight line, the coefficient of friction decreasing with decrease of ZN/P, until a minimum point is reached, after which f rises rapidly in the region of unstable lubrication. The effect of running in is almost negligible at the higher values of ZN/P, but is quite noticeable around the point of minimum friction. Here, there is a progressive decrease in the value, explained by the burnishing effect.

In practical terms, the effect is an increase in the factor of safety of the bearing. When a bearing is operating above the point of minimum friction, any increase in friction tends to raise the temperature, which in turn lowers the viscosity of the lubricant with a resultant lowering of the friction. Thus equilibrium is eventually reached. On the other hand, beyond the point of minimum friction, the lower the viscosity of the oil the more friction; hence there is an unstable condition. Running in, by reducing the value of ZN/P at the point of minimum friction, increases the range of safe operation and hence the factor of safety, when operating with a given load, speed and lubricant. Conversely, with the same factor of safety it is possible to run a bearing with a much lower ZN/P value, corresponding to a similar lower point of minimum friction, after it is run in. Since the coefficient of friction is lower, the power consumption is reduced proportionately.

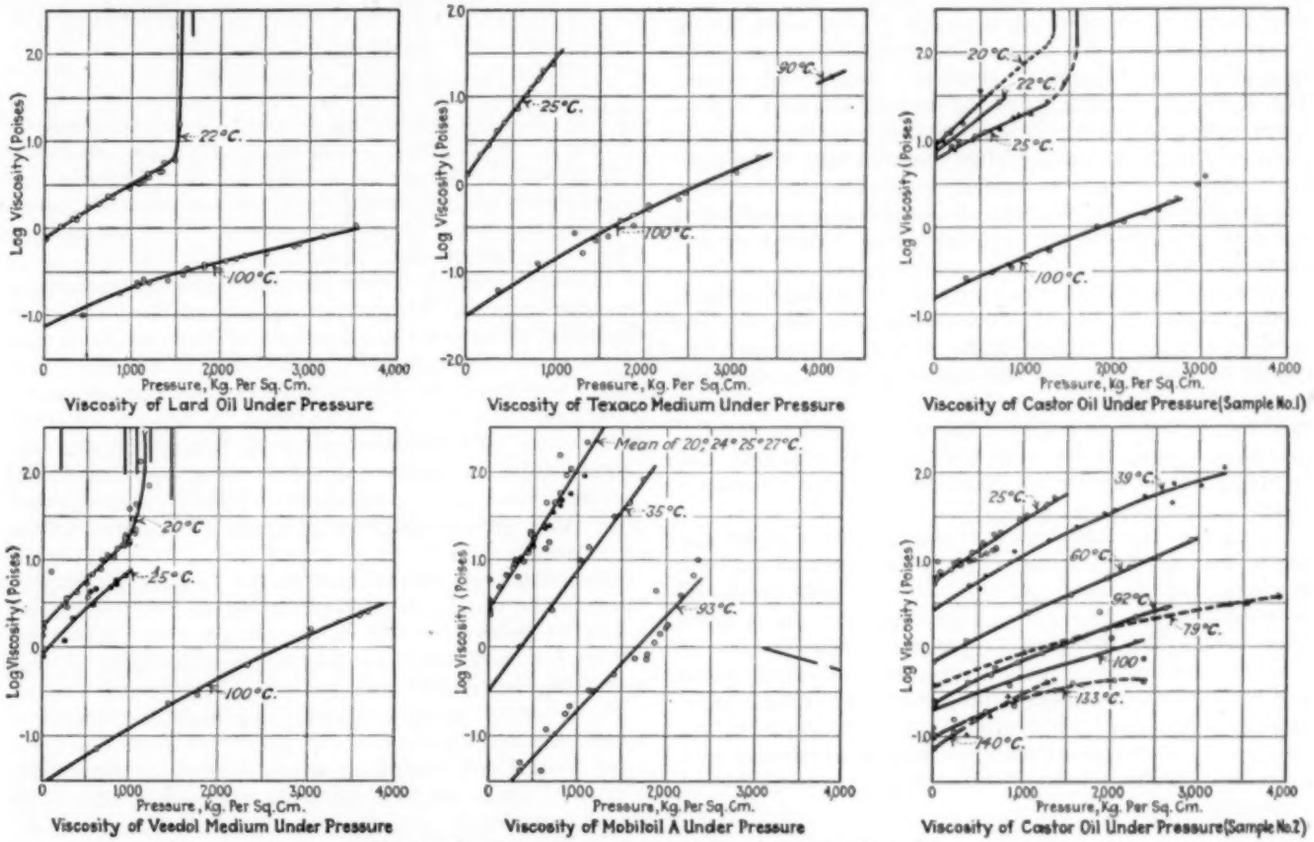
Viscosity of Lubricants Under Pressure

By M. D. Hersey and Henry Shore

ALTHOUGH under average journal conditions, bearing pressures do not reach a very high amount, local conditions may produce much greater pressures, or as in the case of gear teeth and cutting tools, the unit pressure may be quite high. In order to determine the viscosity of various lubricants under such high pressure, the rolling ball viscometer was used. Tests by other investigators had previously demonstrated that the viscosities of fixed oils, including animal and vegetable oils, are relatively less influenced by pressure than those of mineral oils. It has been found, however, that this theory only holds true up to a pressure of about 20,000 lb. per sq.in. Around this pressure certain oils, notably lard oil, show very abrupt indications of solidification at room temperature. The effects of high pressure are presumably similar to those caused by cooling to a low temperature.

The results of the tests are plotted in the accompanying charts. It will be seen that both the lard oil and the parafin-base mineral oil (Veedol) give pronounced indication of apparent solidification. One of the castor oil samples (No. 1) shows a faint tendency to solidify, while the remaining oils show no indication of solidification.

It was also found that the temperature coefficients of all the oils, except lard oil, are greater under pressure.



Charts showing viscosity of lubricants under pressure

The Development of Machine Tools from a User's Viewpoint

By F. C. Spencer

Assistant Superintendent, Manufacturing Development
Western Electric Company, Hawthorne Works

ENGINEERING and design of the machine tools is strictly a function of the builder and should remain so. In the past, however, the builder has welcomed and solicited suggestions from the users of his equipment. This collaboration of the user with the builder is highly necessary, particularly in a plant like the Western Electric Company, where much of the equipment has to be adapted to special needs.

For several years it has been necessary to purchase or build two to three million dollars' worth of machinery per year, and certain standards have been adopted by the company with relation to the design of machines used in their plant. They are as follows: Minimum floor-space requirements; elimination of accident hazards as far as possible by properly designed guards; reduction of physical effort by the provision of convenient operating arrangements; cleanliness secured by preventing the machine and cutting lubricants from leaking or being thrown from the machine; and appearance.

Progress in the machine tool industry toward properly-guarded machinery and well-designed motor drives has been slow. Consequently it has been necessary for this company to keep several designers and a large force of mechanics on this class of work to take care of additional equipment bought to increase the manufacturing capacity. Late-model multiple screw machines, ordinarily furnished

with a motor on top, are now arranged with motor drives built in or on a special bracket so located that the heighth of the machine is not increased. They are a radical departure from standard equipment. In the case of some of the larger machines the motor is located at the stock end of the machine on a special base.

The Western Electric Company punch presses are also individually motor driven. They have incorporated in their construction a special design of friction motor drive. The bearings are bronze bushed throughout and the crankshaft bearings are split on an angle so that none of the pressure comes on the caps. The crankshaft is made of heat-treated chrome-nickel steel as a matter of safety. The flywheel, which is mounted on ball bearings, is provided with several key-locking grooves to effect a minimum of clutching time. These presses are completely guarded, including a balanced swinging gate and side gates to prevent the operator from reaching around the front guard. Punch press accidents at Hawthorne are extremely low.

Several types of automatic and semi-automatic drilling machines have also been developed by the company for particular use in drilling thin stock. The object has chiefly been to cut down the handling time through the use of dial feeds. In another type of double-opposed machine, the work is held in a turret and the drilling head moved to and from the work hydraulically. In fact, this company favors hydraulic feeds on much of its equipment.

The author recommends that the machine tool builder equip his machine with fuse boxes, switches, light brackets, and the necessary conduits, and that he should provide adequate and well-designed guards. It is much more costly for the user to put these attachments on himself than to have the manufacturer do so at extra cost. He also recommends the use of anti-friction bearings and centralized oiling systems to reduce maintenance charges. The design of more semi-automatic machinery, especially for the manufacture of small parts, should be encouraged.

Budgetary Control

By J. P. Jordan
Consulting Industrial Engineer

TOO few executives study the psychological factors that enter into their organization procedures and into the personnel problems that are ever present in both large and small organizations. Too few executives realize that every human being takes an intense pride in his work, provided his scope of responsibility is so clearly defined that it can be regarded by each individual in a very personal way. This is the basic consideration in bonus incentive and profit-sharing plans. Budgetary control is a mechanism that should be thoroughly understood before it is employed by any management, but all executives who fail to appreciate that budgetary control has its greatest value in the psychological effect on the organization as a whole are lacking in one of the greatest essentials of successful management.

Budgetary control supplies to every one in any kind of a business institution a species of a game. The setting of quotas of performance and budgets of expense, brings out a cool and calculating thought of the future, and what it should yield. The daily watching of the current transactions becomes as absorbing as the watching of a score board of a World's Series game. A par has been set and must be beaten. It is a matter of pride to those charged with the duty of setting up the budget to make good and to beat the quota for quantity of business or the budget of expense as originally set up.

Budgetary control is a live and breathing mechanism that brings into play the vision, imagination, action, and whole-hearted interest of every individual in an organization who is privileged to become involved in any way with its operations.

Control of Factory Overhead

By H. G. Perkins
The Murray Corporation of America

THE control of factory overhead is almost synonymous with good management, yet many so-called well-managed firms make no attempt to reduce the so-called uncontrollable items of overhead, such as insurance and depreciation. Close analysis will often reveal considerable saving in this regard.

A budget control system presupposes a cost-reduction consciousness on the part of the executives. Tactful discipline of executives, education of supervisors in cost of materials and service of their own departments, and study or research to determine better and cheaper materials and methods are all essential to expense control. Expectancy of promotion, personal recognition and appreciation by the higher executives, assignment of added responsibilities and the payment of bonuses to executives often also greatly influence the esprit de corps of an organization.

Uniformity of output is a factor of greatest importance in the standardization of costs, and for this reason a rate of production not in accordance with current demands for the finished product is often advisable so that costs may be maintained at their proper levels.

A properly designed and vigorously administered budget control scheme is a very powerful means of overhead control and should cover such points as the attainability of quota set; a voice in the setting of quotas by department heads; the provision of cost data for guidance of department heads; the establishment of well-defined standards of operation for various departments to act as checks on estimates and means for forecasting future performances, and the careful comparison of results with quotas to determine possible future economies. By the continual process of forcing intimate investigations and analysis of operation of his department, the department head is educated into the essentiality of expense reduction and prudent authorization of department expenditures. When a department head is allowed a voice in setting his own quota reasonably close and is expected to attain this quota, he is most likely to give the affairs of his department the close scrutiny that the preparation of an intelligently-set quota requires.

Some Essential Principles for Budgetary Control

By Harold Vinton Coes
Vice-President and General Manager, The Belden Manufacturing Company

THIS paper presents in condensed form many of the essential principles for the application of budgeting to a business and the effective means for control. Several examples are illustrated by charts and diagrams. The author indicates that the budget should be built up from facts developed by analysis of the trends and tendencies

of the past, and by isolating those factors that will influence the costs of the business in the future. The places where control can be most effectively obtained initially in the method, procedure, recording and performance, should be ascertained. There is no uniform set of standard ratios expressing the various fundamental relationship between expenses and sales but these ratios must be determined individually and then applied to the budgeted expense item.

A prerequisite to successful budgeting is adequate accounting and statistical records. Control can be obtained by frequent comparisons, not less than once a month, between actual and budgeted expenses. The factors subject to budgeting are capital expenditures, sales, sales expense, production (including materials and labor) and manufacturing expense. Cash requirements can also be budgeted. The most difficult budget to prepare is that relating to labor, but frequently an approximate control can be obtained by using predetermined ratios of direct labor costs to the cost of sales of various classes of products.

The Steel-Wool Industry

By Crosby Field
Vice-President, Brillo Manufacturing Co.

IN THIS paper the author describes the shaving block machine, the Brillo-Field process and other machines used to produce steel wool. All of the machines use wire as raw material. The article is illustrated with photographs and patent drawings and treats the construction and operation of each machine is detail.

Operating Costs of Electric Industrial Trucks and Tractors

By C. B. Crockett and H. J. Payne
The Society for Electrical Development, Inc.

THE direct costs of operation of electric trucks may be divided into fixed charges and operating charges. The fixed charges are easily defined and hence readily available. They include depreciation on the truck and tractor, the storage battery and the charging equipment; and interest, insurance, and storage charges for these three items, amounting generally to about 7 per cent all told.

Operating expenses include only power and maintenance. The greatest portion of the cost lies in the fixed charges of the equipment. In the average installation the electric truck costs about 50 cents per hour to operate, although in specific installations there is a considerable variation in this figure.

In figuring the net cost of operation, the user should consider the following factors: Decrease in interest charges on manufacturing and storage facilities, and on inventories, as well as decrease in insurance charges on these items. There is also a decrease in labor burden and managerial overhead, in idle hours of machines and workers, in charges for goods broken in process, in hazards to workmen, and in general morale. If interest charges on the contemplated system be included in the cost and if all savings are charged as costs of the old system, the difference between total costs will then be the net yearly profit accruing from the change. An outline for such computations is included in the appendix to the article.

Materials Handling as an Aid to Production

By Frank L. Eidmann
School of Engineering, Princeton University

THERE are several viewpoints from which the feasibility of installing material-handling equipment should be considered. With regard to the design of the building, the present method is first to study the material-handling problem, then plan the proposed arrangement of equipment and finally the design and construction of the building to meet the requirements of both. Material-handling methods are often important factors in conserving floor space, and it is sometimes possible to save the cost of additional buildings by the installation of proper handling and storing methods. A study of the total weight of material and tools that have to be handled in the plant to produce a pound of finished product will often reveal worth-while savings that can be obtained by installing handling equipment. In one foundry, for instance, it was found that 206 tons of materials had to be handled in order to make 1 ton of iron castings. Obviously efficient handling would cut down the cost.

Another angle from which material handling affects costs is in its influence on the inventory of stock in process. If the material can be kept moving without delay from operation to operation, it is possible to run the plant on a much smaller inventory which results in a reduction of invested capital. It is also possible to increase the output of each worker by delivering material to him at the rate at which he can use it. In this case the conveyor serves as a pace setter and usually shows increase in output.

The handling of a heavy or bulky article should be kept in mind when it is designed. Lugs provided on heavy castings will greatly facilitate handling by crane, and the parts of machines can often be designed so that they may be picked up by electric or hand-operated lift trucks. The selection of handling equipment is not always a simple matter because sometimes it would appear that any one of several types would serve equally well, and as a total analysis of all the influencing factors will usually show that one of the several types will have a definite advantage over the other, it is best to have the final selection of handling equipment made by an expert who is not partial to a single type of equipment.

More important, even than the consideration of handling cost, is the provision of safety to the operator of the equipment and to the other workers in the plant. In general, however, any equipment that reduces the manual hazard will greatly decrease the number of accidents. Another point to consider is the possibility of co-ordinating equipment with other handling equipment at the plant as well as with the production equipment. This phase refers particularly to the transferring of loads. The matter of fire insurance rate is also sometimes influenced by material-handling methods. Such systems usually allow for the rapid removal of stored material, thereby reducing damage by sprinklers or by fire.

The last of the viewpoint from which the subject is considered is that of co-ordination of handling methods in the plant and the shipping methods. Some firms now specify that shipments come to them packed on skids and even go so far as to send the shipper a set of printed instructions as to how he should arrange the loaded skids in freight cars to facilitate unloading.

Book Reviews

THE SLIDE RULE. By Charles N. Pickworth. One hundred thirty-four pages, 5x7¼ in., cloth-board cover. Published by Emmott & Company, 65 King St., Manchester, England. Price 3s, 6d.

WHILE a larger portion of the contents of the volume remains unchanged from that of the preceding edition, several chapters have been rearranged in a more convenient form to include descriptions of new slide rules and calculators that have been recently introduced. After outlining the principle of the slide rule and its operation for the more common problems, using both the upper and the lower scales, the author describes its use in connection with square and cube roots, trigonometrical application, combined operations, the solution of algebraic equations, screw-cutting, gear calculations and other problems. Thirty-six illustrations and several reference tables are included.

The examples selected will suffice to illustrate some of the many and diverse uses of the instrument in the every-day work of the engineer, as well as its application in other directions. The data should enable those interested in slide-rule calculations to grasp the fundamental principles underlying its operation. Inasmuch as this volume is the eighteenth edition, the first having been published in 1894, its popularity is clearly evidenced.

VENTILATION AND HEALTH, THE NEW HYGIENE OF FRESH AIR. By Thomas D. Wood, professor of physical education and adviser in health education, Teachers College, Columbia University, and Ethel M. Hendriksen, former executive secretary, Tuberculosis and Public Health Association of Rochester and Monroe County, New York. One hundred and ninety-eight 5x7½-in. pages, cloth boards. Published by D. Appleton & Co., New York City. Price $2.

THAT fresh air is essential to health is becoming generally understood, but the knowledge of ventilation, its relation to health and how to secure it is by no means widespread, according to this book. The authors explain the science of ventilation according to theories lately adopted, and show how these theories may be applied.

Besides the chapters telling of the effect of ventilation upon health, there are several of particular value to industry: "Window-Gravity Ventilation in Factories; Window-Gravity Ventilation Practicable for General Use; Ventilation Costs; Devices to Aid Ventilation; Instruments Used in Ventilation; and Educational Methods."

STEEL AND ITS TREATMENT. By D. K. Bullens. Five hundred sixty-four pages, 6x9 in., 391 illustrations, cloth-board cover. Third edition. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Price $5.

IN THE third edition the author includes descriptions of the many advances made in metallurgical science and in the art of heat-treating steel, brought out since the earlier editions were published. Dividing the text into three sections, in the first he deals with the tests of steel, such as static, repeated impact and miscellaneous stress; the structure of steel; and annealing, spheroidizing, hardening, tempering, toughening, case-carburizing, and thermal-treatment practices, all of which enter the metallurgical phase. The second section covers the engineering phase, dealing with the structure of carbon and alloy steels, giving the physical results representative of the different steels, together with their treatment.

Covering the production phase, which constitutes the third section, the author treats such points as heat control, the importance of cooling, time factors, and the selection of the heating energy and equipment, as well as the importance of the human element. The difference between control of temperature and control of the heat-treated product, a point not properly sensed by the trade, is treated in detail. Likewise, the importance of cooling, frequently misunderstood, or entirely disregarded, is dwelt upon. A chapter of importance, "Electrical Equipment for Heat Treating," has been included in order to cultivate a better understanding of the principles that often warrant the selection of electrical devices.

MACHINE DESIGN DRAWING ROOM PROBLEMS. By C. D. Albert. Three hundred fifty-five pages, 6x9 in., cloth-board cover. Second edition. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Price $3.50.

INTENDED primarily as a text book for educational purposes, the information is confined to that needed for a drawing-room course in general machine design. The important changes in this edition are the revision of several reference tables, extended discussions of tolerances and metal fits, and screw threads and screw fastenings. Ten chapters are included in the contents, namely, General reference, Materials, Factors of safety and allowable stress, Pump problem, Slide-valve and valve-gear diagrams, Steam-engine flywheel, Combination punch and shear, Balancing problem, Upright drilling machines, and Mechanical features of a jib crane, the last of which has been added. At the conclusion of the last seven chapters, dealing with design problems, estimated times required for the completion of each division of the problem are given. Applications of a practical and theoretical nature are developed as required in connection with each problem.

In treating the design of the various units covered in the problems, the author defines the principles of each part, gives details of their construction, outlines terms and definitions, and discusses their manufacture. Line drawings and halftones are used to illustrate constructional features of the units discussed.

ANNUAL REPORT OF THE DIRECTOR OF THE BUREAU OF FOREIGN AND DOMESTIC COMMERCE FOR THE FISCAL YEAR ENDING JUNE 30, 1927. This 57-page, 6x9-in. pamphlet sums up comprehensively the work of the Bureau of Foreign and Domestic Commerce for the past year. An increase of nearly 23 per cent in the total number of commercial services rendered to firms, as compared with the previous year, indicates the important position which this Bureau is now taking in industry.

More attention was given during the year to domestic industry, and striking success has apparently been achieved in co-ordinating the efforts of industry to eliminate waste in manufacture and improve marketing. The pamphlet gives an outline of the various functions of the Bureau and of the work that was accomplished both at home and abroad. Copies of the booklet can be purchased for 10 cents from the Superintendent of Documents, Government Printing Office, Washington, D. C.

Press Tools Help Make Automotive Accessories

By FRANK W. CURTIS
Western Editor, American Machinist

STEWART-WARNER products require in their making a variety of press tools embodying constructional features of an up-to-date nature that, to a certain extent, are responsible for cost reductions in the manufacture of sheet-metal parts. Foremost of the press operations, are tools for forming and drawing odd-shaped parts, such as are illustrated in the examples that represent a miscellany of dies for diversified products.

Compressor heads for Alemite grease guns, made in a variety of sizes, first are blanked and drawn cup-shaped after which six other drawing operations are required to form the neck end. The blanking and drawing die for one of the smaller units is illustrated in Fig. 1, in which the work-piece is outlined at the lower right-hand corner. The blank is drawn from 0.065x2¾-in. sheet steel to the outline shown at *A*. The strip *B* is located from the previously pierced hole by the finger *C*, as the sheet is advanced. The die has attached to it a stripper pad and a knockout plate, so that the strip and the drawn cup are removed from the punch on the upward stroke of the press ram. In Fig. 2 is shown a layout of the dies used for drawing the neck, the one at *A*, being for the first operation, and continuing to the one shown at *B*, which is for the sixth draw. These draws are performed by two sets of dies, each of which handles three operations. The set-up for the second set of draws is illustrated in Fig. 3. A similar set-up is used for the first three draws. The work-pieces are placed in a dial feed-plate that accommodates ten parts. Each stroke of the press indexes the plate one station, so that the work progresses over the three dies attached permanently to the bolster of the press. In this way, a piece is completed at each press stroke. The pin shown at the left, which is attached to the ram, ejects the finished units from the feed plate. At *A* is shown a compressor head as it is received for the first set of draws, and at *B* is shown a head as received from the dies illustrated. A finished head may be seen between these parts. After the press operation, the work is tapped and knurled.

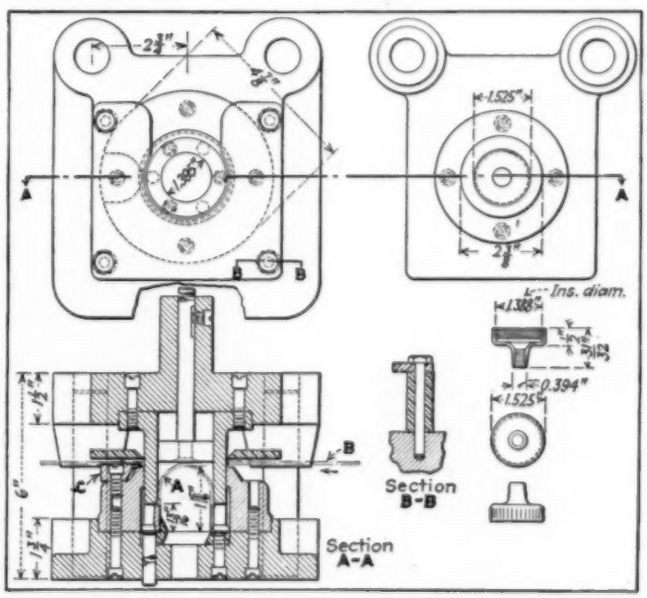


Fig. 1—Blanking and drawing die for compressor heads. The die is equipped with a stripper pad and a knockout plate, so that the drawn shell and the stock are stripped from the punch on the upward stroke of the ram

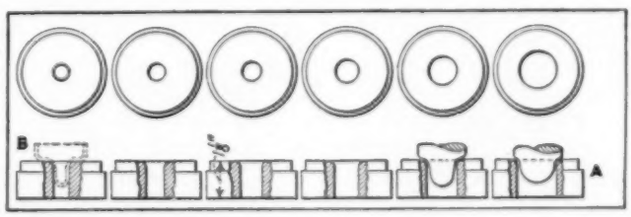


Fig. 2—Layout of redrawing dies. The neck is formed on the head in six successive operations, starting in the die A and being completed in the die B. There are two sets of dies, three in each set

Magnet cups, used in speedometer assemblies, are made from 0.02x2-in. deep-drawing brass ribbon. The first operation is performed by the progressive die illustrated in Fig. 4. The stock travels from right to left and five operations are performed. In the first station, the opening between the blanks is cut out, and the remaining four stations blank and draw the cup to shape. At *A* the blank receives its first form in which the center is drawn to 0.50 in. in diameter and 0.145 in. in depth. The outline of the work, as completed in the second draw, is shown at *B*, and at *C* it is shown as completed by die at the station *D*. In the last station *E* the work is trimmed from the blank and is forced through the die. After the strip has reached the last station, a cup is completed at each stroke of the press. The punches and dies for each station are constructed individually, so that either portion can be replaced if necessary without having to build an entire new unit. A similar type of die used for blanking and forming valve bushings is illustrated in Fig. 5. This die has six stations and completes the part to the shape shown at *A*. Following this operation, the $\frac{1}{16}$-in. hole in the end of the bushing is pierced in the die shown in Fig. 6, which employs a dial feed-plate having sixteen nests. A pillar-press die assembly, as outlined at *A*, is used. The die shoe is extended forward beyond the front face of the punch holder, so that the dial feed-plate has a suitable support as

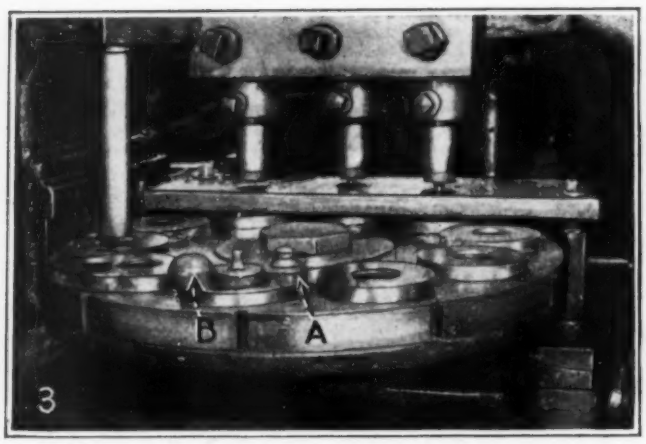


Fig. 3 — Set-up for the second set of redrawing dies. The press is equipped with dial feed, the plate holding ten pieces. At each stroke of the press the plate is indexed one station, completing one piece per stroke. A pin attached to the ram ejects the finished piece from the plate.

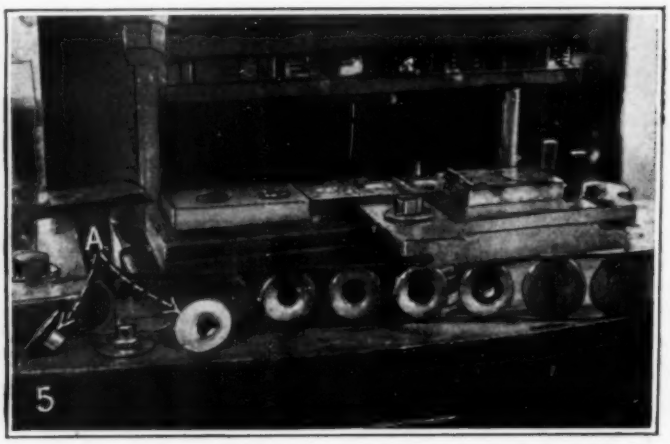


Fig. 5—Die for blanking and forming valve bushings. This die has six stations and completes the part shown at A. It is similar in type to the die shown in Fig. 4

well as a bearing at *B*. The plate is indexed one station at each press stroke by a pawl, operated by a rod connecting the crankshaft of the press and the lever *C*. The lever *D* receives motion from lever *C* and transmits it to the pawl *E*, through the sliding plate *H*. The pawl engages the notches in the feed plate, thus indexing it one station at each stroke. The feed plate is locked against motion in either direction, except when being operated by its pawl, by the safety latches *J* and *K*. The layout

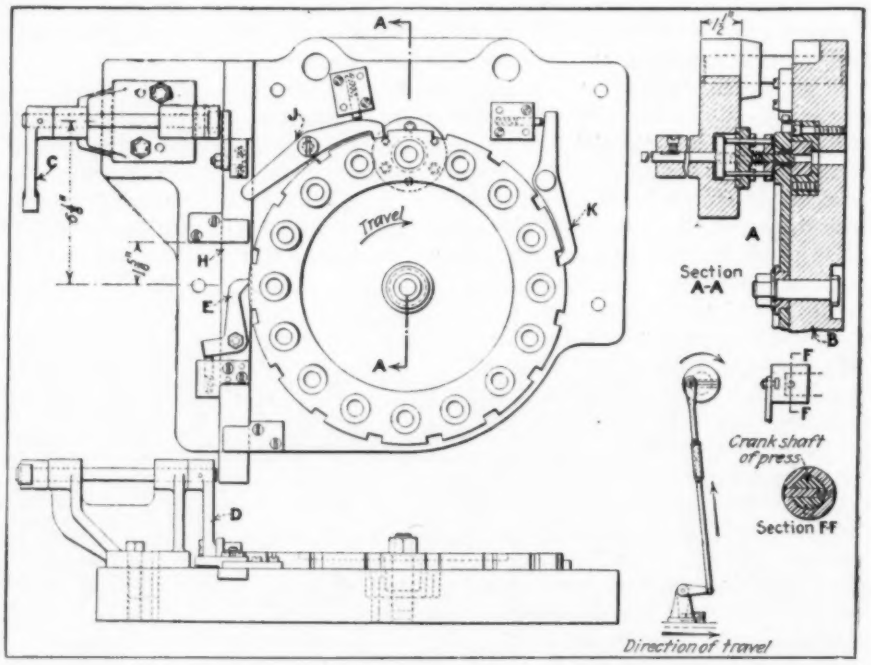


Fig. 4—Dies for drawing magnet cups for speedometers. The stock travels from right to left and five operations are performed. At the first station, the opening between the blanks is cut out, while at the other four stations the cup is blanked and drawn to shape

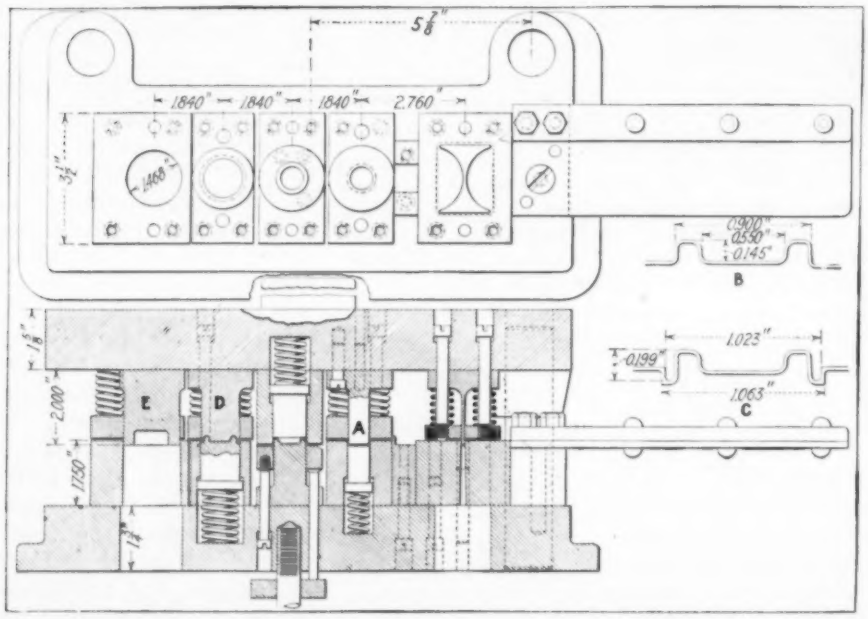


Fig. 6—Die for piercing the end hole in the bushing. The die assembly is of the pillar-press type, and the dial feed-plate has sixteen nests. The plate is indexed from station to station by a pawl engaging in notches in the periphery

shows the relative positions of parts of the mechanism at the bottom of the press stroke, in which position the indexing pawl is on its forward stroke, midway between two indexing notches.

Ferrules for the flexible shafts of speedometers are drawn from sheet steel, in coil form, 0.031x2⅞ in., by a series of operations, the first of which blanks and draws the cup to the outline shown at *A* in Fig. 7. The cup is then annealed, after which the first redraw, as outlined at *B*, is performed. Following this operation, the cup receives its second annealing, then it is

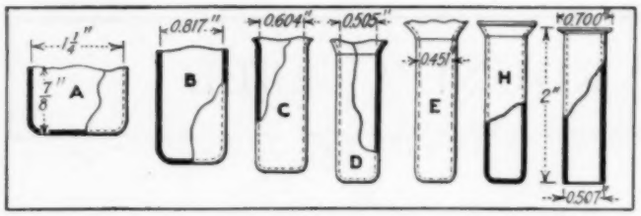


Fig. 7—Stages in forming ferrules for flexible shafts

redrawn as shown at *C*, annealed again, redrawn as shown at *D*, and then finally receives its fourth annealing and redrawing operation, bringing it to the shape indicated at *E*. In the next operations, the hole in the bottom is pierced and the flange is trimmed as shown at *H*, after which the final operations, trimming and flattening the flange and setting the bottom end, are performed, thus completing the ferrule as outlined at the right.

The second redrawing operation, reducing the inner diameter from 0.817 to 0.604 in., is handled in a horizontal press, as illustrated in Fig. 8. The cups are placed in the vertical magazine *A*, and are fed automatically to the die from where they are redrawn by the punch *B* that forces them through the die and into a chute at the rear. The press is kept in continuous motion and requires feeding only to complete the operation. Samples of the work before and after drawing are shown standing on the punch slide.

Piercing the hole in the bottom of the ferrule is done in a die, similar in operation to the one shown in Fig. 3. The layout is illustrated in Fig. 9. The work passes

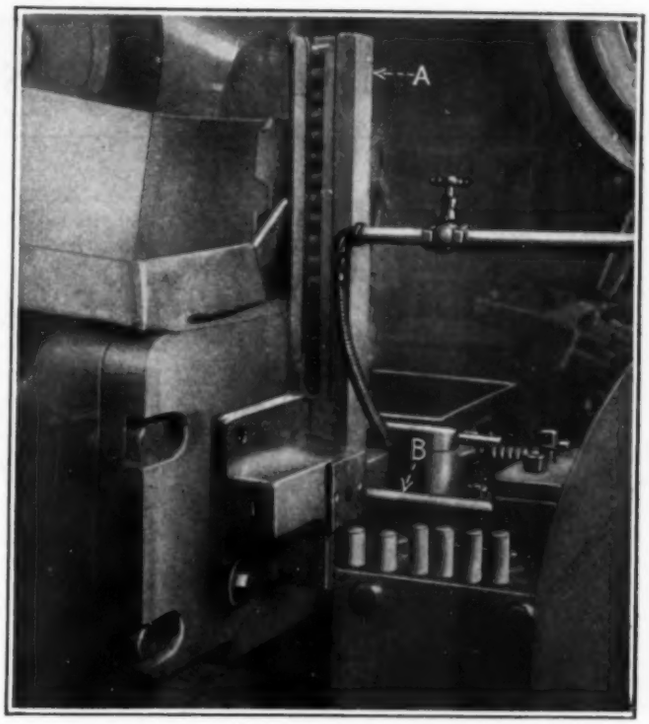


Fig. 8—The second redrawing operation on the ferrule is done in a horizontal press equipped with a magazine feed, this feeding being automatic. The press is kept in continuous motion. Samples of the work before and after redrawing can be seen standing on the feed slide

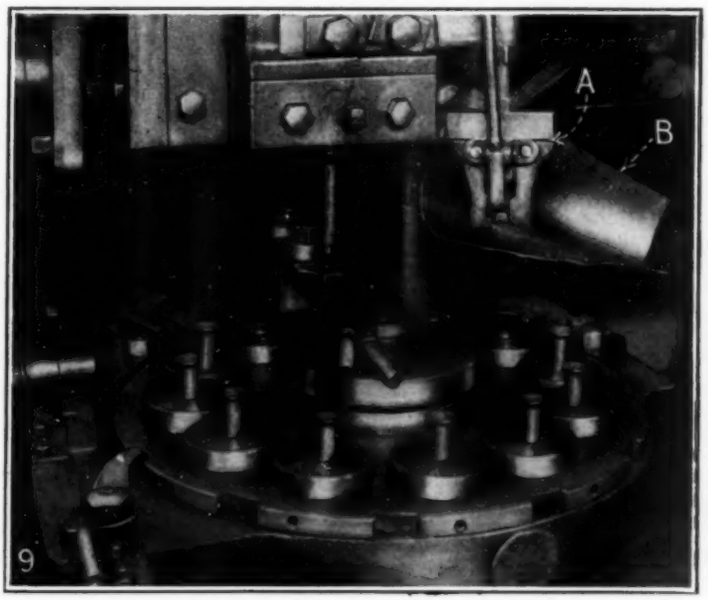


Fig. 9—Piercing the hole in the bottom of the ferrule is done in a press equipped with dial feed. The work is ejected from the nests by the spring finger A, which is operated by connections to the ram.

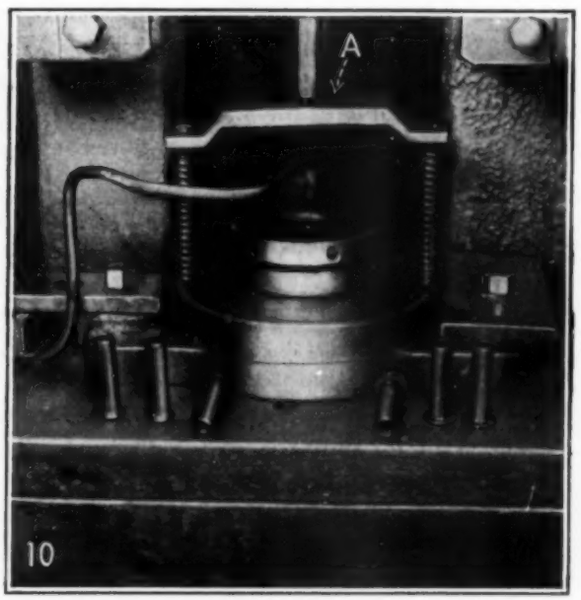


Fig. 10—Die for flattening the flange and squaring the bottom of the ferrule. The work is stripped from the punch by the plate A as the punch ascends, and air from the line at the left blows it to the rear and into a tote box

the die from left to right, and is withdrawn from the nests by the spring-finger *A*. This device has attached to it an arm that operates in connection with the travel of the ram, so that just before the ram reaches the top of its stroke, the work is ejected from the spring fingers into the tray *B*, from where it falls into a tote box resting on the floor. The die that flattens the flange and sets the bottom end of the ferrule is shown in Fig. 10. Stripping the work from the punch, is done by the plate *A*, as the punch ascends. Then, as the work is free, air coming from the line shown at the left, blows it to the rear of the die into a tote box. When several tote boxes have been filled, they are taken to the next department in line.

The engineer's idea of standardization is not to prevent progress, but to use the best size, or method, until another has been proved enough better to warrant the change.

THE · FOREMAN'S · ROUND · TABLE

Saving the Job of the Careless Workman

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"GOT called on the carpet, did you Al? Saw Williams' messenger send for you this morning."

"Not exactly, Ed. Sort of handed me a bouquet, instead, for a change."

"What have you been doing, now, Al?"

"Well, if you must know, it was about Joe Miller. You may remember when Miller came near getting fired for being plumb careless over in the milling department. Well, he just missed wrecking a good machine and getting a couple of men hurt into the bargain. He'd been warned before, but he was just naturally careless."

"Well, Al, where do you come in?"

"Williams called me into the office, and asked me if I'd take Miller and try to pound a little sense into his head about being careful. Told me he'd known Miller's family, and that he hated to fire him except as a last resort. So I tackled the proposition—and Williams thinks I did a pretty good job."

"And how did you work it, Al?"

"First I visited Miller at his home. Had a long talk with him and also the 'missus.' Williams had told me that things were not always smooth at home. So I got down to brass tacks, and told them both that here was the last chance. We wanted to give Miller every opportunity to make good but that we couldn't stand for any more carelessness. I even went so far as to say a man on nice work and on intricate and expensive machines had to have as peaceful a mind as possible in order to make good. I'd heard she nagged him a bit. And I wanted her to see that nagging, no matter how much he deserved it, might lose him his job."

"Kind of ticklish business, Al. I'd hate to suggest it to some wives I know—Been easier to have fired him."

"I know it, Ed. But it seemed to work out O. K. Miller is a good man, and hasn't pulled a bone since. If we'd fired him for carelessness what chance would he have had to get another job? Anyway Miller is a good man otherwise, and we don't want to fire him if we can help it."

Was Williams justified in trying to save Miller's job? Was it necessary to go to Miller's house? Or should they have fired him as an example?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Insurance and Savings in the Shop

IT IS a fine thing to encourage the habit of saving. I believe that one of the best things a foreman can do for an apprentice is to get him started on the road to a bank account. If the apprentice can be taught the idea of saving his money, I think it will be easier for him to see that it is a good thing to take care of company owned tools and machinery, since he can better realize their value if he has learned the value of saving his own money. Endowment insurance is a mighty good plan to use as a plan for saving money, since it not only protects the beneficiary in case of the death of the insured, but it also provides a sure and stated amount of money if the insured lives to the end of the endowment period. As mentioned in the article, many a man will join an insurance club who would never enter a bank. The idea that the foreman of the auto parts shop started out with was a good one, well worked out, and it certainly worked well for those who started saving by that plan. A great many of the large companies provide some form of insurance for their employees, and I believe they find that it pays. I think the employer has a right to "butt in" to the private life of his employees, providing he has an honest interest in their welfare. I know I always like to feel that my employer is interested in me and my family, and I am pretty sure the average employee feels much the same way. —FRANK A. HYDE.

WITH a full appreciation of the valuable part that insurance in all its phases is paying in our lives today, I still feel that the workman resents the insurance his employer may take out for him as a paternalistic gesture. The employee appreciates that it is not something for nothing, and he would rather have the equivalent money in his pay envelope. Then, exercising his own initiative, he may invest more or less in insurance to suit his particular needs. —N. RICHARD.

Posting Too Many Rules

WHEN a bulletin board is covered with posted rules, they become ineffective, as nobody knows a new rule when it is put up.

The foreman cannot go to every new man who comes into the shop and recite a whole strong of "do's" and "dont's" to him. Nor can he wait until a man violates a rule and then jump him for not knowing it. Several firms that I know of have overcome the rule-posting habit by giving a new man when he starts work a card printed with all necessary information. It takes but a few minutes to read over a card like this. Then the man puts it in his pocket, or in his tool box, for further reference. This system leaves the bulletin board clear so that when a new notice is posted it attracts immediate attention. —ERIC HAWTHORNE.

Getting Ideas from New Men

THERE are really few basically new ideas in manufacturing methods. Progress generally comes through adapting an idea to new uses, combining several ideas to form a new combination, or improving a basic idea in some of its details. Therefore, any knowledge that can be gained about manufacturing methods in a related industry, may be applied profitably either directly to a detail, or in combination with existing procedure. This knowledge is generally gained by direct observation, reading, experimentation, or by word of mouth. So, in asking the new man about methods, Al was merely applying the latter method. The only trouble to be encountered, which, after all, is hardly that, is from the man who is so narrow minded that he feels indignant if his idea is not adopted in toto. If an idea is advanced, and it is not considered good, the foreman owes it to the man to explain why it is not feasible. The best executive is the man who will always accept his subordinate's ideas unless he can show that he has a better one. To insist on his way merely because it is his idea and he is the boss, is to confess a weakness which is not a proper attribute of the executive mind.

—GORDON THRONE.

THE · NEXT · TOPIC

Side-Tracking an Old Customer

ADVANCE QUESTION

A new customer's order is likely to be delayed. Ed suggests sidetracking an old customer. Al says the old customer should have preference. What should be done about it?

Making Time Studies

IT IS a matter of common observation, that many men slow down very decidedly if they suspect that anyone is timing them in the shop. It is not honest for them to do so, but self-preservation comes before honesty in the minds of a great many. Timing a man in secret is no more honest, because it gives the man no opportunity to explain why he is getting out a lot of work today and did not do so much yesterday. He had some hard castings yesterday, or he had a driving belt that was slipping under full load.

The only worthwhile way to time study, is by having a man who is sufficiently rewarded so that he is willing and anxious to give a job a good tryout, and a timekeeper that is a good enough mechanic so that he will understand the handicaps which the workman is suffering. Promiscuous time study is futile. —ENTROPY.

Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

Second-Operation Work on a Screw Machine

By Donald A. Hampson

The screw shown in Fig. 1 is made in lots of 10,000 on an Acme automatic. A fixture for 90-deg. indexing was used on a hand-milling machine to cut the cross slots in the head, an operation that was much slower than the screw-machine work. In order to eliminate the expensive hand-slotting operation the machine shown in Fig. 2 has been moved into the screw-machine department. This is a ¾-in. Hartford screw-machine that has been converted into an automatic screw slotter by a simple change. A casting was made that was bolted to the frame in place of the headstock, which was removed and reset on the free end of this same casting. In its new position the headstock stands at a right angle to its original center line, in such position that a cutter held in its spindle centers over the line of travel of the turret.

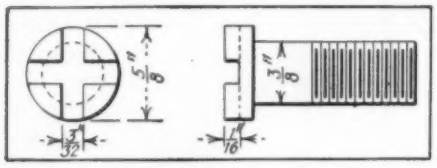


Fig. 1—The screw to be slotted

A Cushman universal chuck has been substituted for the turret casting, and into it the screws are dropped with the heads up. The turret drum has been cammed to feed the screws under the cutter twice in a cycle at a proper rate of feed for slotting, and far enough to allow room to revolve the chuck at one extreme of travel. A period of dwell has been arranged at the other extreme that is long enough in duration for the operator to change the screws.

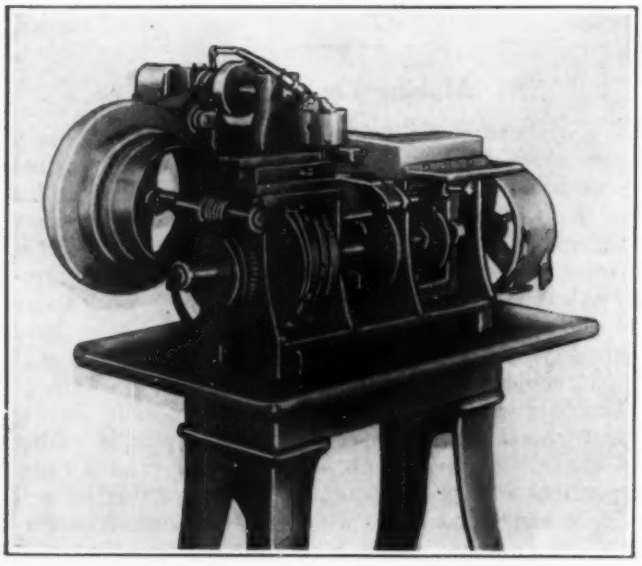


Fig. 2—The converted screw-machine

The total travel of the slide is only 2 in., but this leaves enough room for all the movements and for loading, the operator being protected during this part of the work by a sheet-metal guard over the cutter.

This screw-machine had been in storage and was slated for the junk man, escaping only when its utility as a slotter was suggested. The conversion was quite simple—a bracket casting, cams for the drum, and a chuck fitted in place of the turret casting, being the new parts. Superfluous old parts were left undisturbed. Oil is pumped on the cutter, and a feed belt drives the worm shaft.

Although too light for screw-machine work this machine fits in very well as an auxiliary. The screw-machine operator sits at this screw slotter when not engaged at the automatics, and is able to slot the output of screws during such periods, thus saving all of the time formerly occupied at this job by another man.

Suggested Improvements for Drill-Press Tables

By Charles Pencoyd

In a jobbing machine shop the drill press is often utilized for many operations other than drilling and tapping, and it is the writer's opinion that its usefulness could be very materially increased if the builders would give greater consideration to the underside of the table. The round table is the most common, and is extremely handy when it is desired to shift the work from one point to another. The tops of such tables are provided with slots in which T-head bolts may be used conveniently to secure the work, but many times the work is of such shape as to require the application of parallel or C-clamps, and when we come to apply them we discover that there is something seriously amiss with the underside of the table.

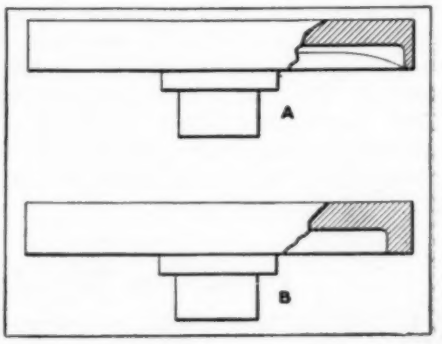


Fig. 1—Suggested improvement in tables for drill-presses

The only part of the under surface available to which a clamp may be affixed is the rim, and that is usually

too thin. If it is necessary to set the clamps farther back, the operator is out of luck unless he resorts to the use of blocking to build up a surface against which to rest the clamp.

The sketches herewith may serve to suggest to the manufacturers a way to improve the design of their tables. In Fig. 1 at *A* is shown the usual construction while at *B* may be seen the suggested improvement. The first view shows the thin rim with the rounded rib curving away from it and providing no resting place for a clamp. The other view shows the same table with a thick rim and heavy radial ribs of rectangular section, the whole being machined off in one plane.

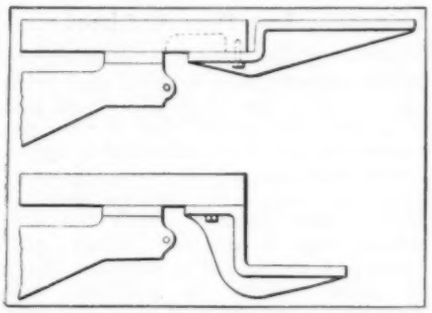


Fig. 2—An attachment to increase the size of the table

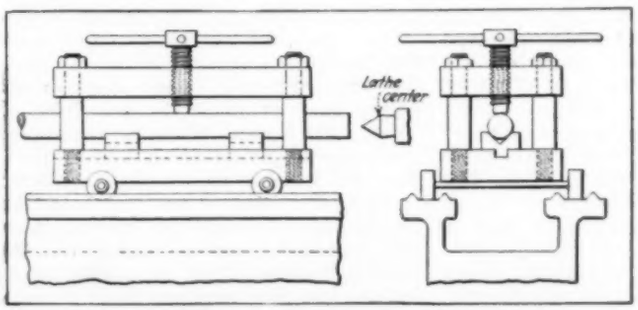
When made in this way, a surface is provided not only for clamps, but to which an extension, as suggested in Fig. 2, may be permanently or temporarily attached for use in connection with the many jobs of large dimension, but of light weight, that come to this machine for various operations.

A Shaft-Straightening Fixture for Large Lathes

By H. L. Wheeler

It has been found economical in shops where a great deal of shaft straightening must be done, to provide special fixtures for the purpose. Among many different rigs I have seen, one of the best and most efficient is shown in the illustration. It is simple in construction and may be cheaply made. The general dimensions are governed somewhat by the lathe on which it is to be used, and also to some extent by the size of the shafts to be straightened. It consists of two flat cast-iron plates of about the same thickness and not less than 24 in. long. The plates are separated by four studs having shoulders at top and bottom. The studs are threaded into the bottom plate and the top plate is held to them by hex nuts. A heavy square-threaded screw in the top plate is used to bend the shafts where needed.

Two sliding V-blocks serve to hold the shaft. The blocks are planed so as to leave a solid key on the bottom which fits into a corresponding keyslot in the bottom plate. Four cast-iron wheels mounted on axles attached to the under side of the base, provide rapid means of shifting the device to any point along the length of the shaft. The height of the V-blocks and the diameter of the wheels should be made so that the approximate center of the largest-sized shaft to be handled should come in line with the lathe centers. For shafts under the maximum diameter, packing can be used to raise the V-blocks.



A straightening device for the lathe

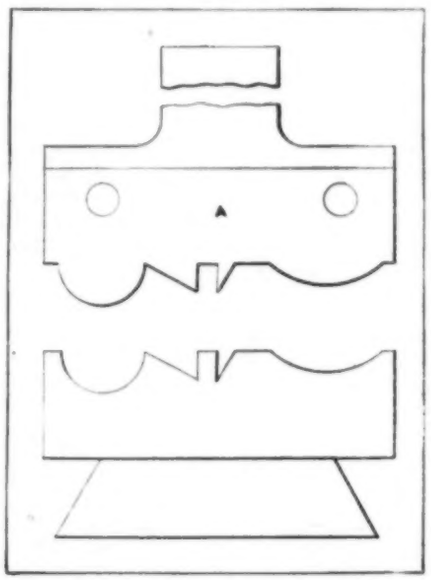
In use, the straightener is placed on the lathe, the shaft is mounted on the centers where it is indicated in the usual way. After marking the high spots or points where a bend is to be made, the centers are released, allowing the shaft rest in the V-block with the high spot in line with the bending screw.

Short shafts can easily be placed in the lathe with the straightener in position. For extra long shafts it is sometimes necessary to put the shaft through the fixture before mounting it on the lathe.

Making Forming Tools

By Charles Kugler

The usual method of making forming tools is to scribe the form on the tools by a templet and to plane or shape them as near to the scribed lines as is possible, then to finish them by hand filing, since they are generally too long to go in a filing machine. A much easier method is to make a master tool from $\frac{1}{8}$-in. flat steel and fasten it to a holder, as shown at *A* in the sketch. Such a master tool can be filed to form in much less time than it would take to finish file the tool proper, and when finished it can be used as a templet. After planing or shaping the tool proper as near to the scribed time as is possible, it can be finished by the master tool in much less time than by filing.



The master and forming tools

In hardening the master tool, it should be attached to the holder while being heated and quenched. By this method there is very little danger of its being warped or cracked.

If a ball bearing runs hot, try reducing the amount of oil it gets. Too much may be worse than too little.

Always note the pitch of the screw in the tail stock of a lathe to use for approximate measuring for depth in drilling or similar operations.

Polishing the flutes of a drill, reamer or milling cutter is said to increase the efficiency materially by permitting the chips to slide easily over its surface.

Technical Abstracts

Automatic Polishing

Automatic polishing is rapidly taking its place in the industry for processing large production of flat pieces or pieces having a portion of their surface flat, and, to a lesser extent, round bars, tubes and contoured pieces. The variety of work capable of accomplishment by automatic processes is rapidly increasing.

Automatic polishing is not as simple as many people have thought it to be. Many conditions arise not present in hand work, for the machine is without the human "feel." The work and wheels are in fixed position with relation to each other and the machine cannot correct imperfections in the work as can the hand operator. It is necessary that the work be brought to the machines in better condition for polishing than for hand work. Flat work must be absolutely flat, and it is often necessary to straighten or flatten it before polishing.

The difficulties encountered are not, however, so much in the machines as in the lack of ability of the operators to tool them properly. Absolute trueness and balance are essential. The wheel must contain within itself the characteristics and qualities which will take the place of the human "feel" in hand work. —Bradford H. Divine, *Abrasive Industry,* November.

The Olympia Automobile Show

Development along orthodox lines in general layout, with some unorthodox details, and advance in bodywork, are the general impressions furnished by a study of the Show chassis. Radical departures from accepted practice are conspicuous by their rarity.

In engine sizes the range of cars has not been extended, the 7 hp. and 120 hp. remaining the two extremes. A general grouping about the 16 hp. size indicates that engines of moderate ratings are meeting the requirements of the average user. Body space is increasing, both as regards length and width, in most cases without alteration of track or wheelbase.

Externally, the power unit is becoming smoother in outline, with smaller overall dimensions for a given cylinder volume. Induction pipes of rectangular section with square corners, or deflector plates, are replacing the streamline flow curves of past systems. For the first time the six-cylinder engines equal in numbers the older four-cylindered models, sharing equally 90 per cent of the cars. The remaining 10 per cent are two, three, eight and twelve cylinders. Superchargers remain outside the standard group of cars, fuel consumption alone restricting their use to the speed car exclusively.

The use of duralumin, or kindred alloys, for connecting rods, pistons, and valve gear, grows rapidly. The problem of eliminating piston slap when cold, without seizure when hot, has been unfolded in many patent specifications for pistons. Coil ignition has taken a leap forward at the expense of the magneto.

The application of a one-way drive between the engine and differential gear has been christened a free-wheel. Probably the name will remain, however the position of the device varies. Between the clutch and gear box is one position, inside the gear wheels, or behind the gear box, are others, all in the experimental stage at the moment. The handling of a car wherein the braking power of the engine is not available is novel. The ordinary individual will need practice to acquire confidence. Gear boxes in unit with the engine are by far the most common arrangement. Three speeds are fitted to about two-fifths of the exhibits, with four speeds on the other three-fifths.

Better roads and low pressure tires have removed the suspension problem from the head of the list of urgent needs. There is little doubt that on the cars of the future each wheel will be free to act according to the obstructions met with, and will not be tied by the other wheel on the same axle. An improvement in the quality of spring steels is evidenced by the decreased amount of metal used in most leaf springs.

Four wheel brakes are practically universal, only 6 per cent of the exhibits limiting the application to two wheels. It requires some skill to adjust two sets of brakes, and still more skill to adjust four separate cables or rods to give equal retarding effort. Systems of central adjustment for all brakes have been known for some years, but only two or three firms showed chassis so fitted. Servo brake gear has made some advance, the most promising being the regenerative shoe, wherein the inertia of the car is used to energize a servo shoe, which in turn applies the main shoes. Pending the realization of the magnetic brake, car inertia seems a better source of braking power than separate servo-gear operated by the engine.

Instrument boards have improved considerably. The grouping of dials, and their illumination, are now almost works of art. Head-light control has received much attention. Lubrication of the chassis has too long been an affair of oil can and grease cup, modified in form by the invention of the grease gun and nipple. Such systems entail considerable unpleasant and uninteresting labor. The ideal of automatic lubrication of all points is brought much nearer by two or three arrangements of central chassis lubrication. There are systems where part of the bearings are lubricated from a single point.—*The Automobile Engineer,* Nov. 1.

Decreasing Lost-Time Accidents

After giving special attention to safety measures over a period of 4 years up to 1925, the Mansfield Sheet and Tin Plate Co. found that it was not preventing accidents effectively, reducing serious injuries, nor lowering compensation costs. For several years it had a most capable guard foreman, whose duty it was to enclose with protective devices all equipment likely to cause injuries to workmen, and although state inspectors called the plant a "museum of safety," accidents due to the human element still occurred, such as dropping tools and materials on feet, cuts from handling material, lacerations, burns, and abrasions.

A determined effort was made to locate the causes of the bad return and correct them. The president of the company took a personal interest in the situation, and the entire group of executives united with him to lick the problem. The safety director familiarized himself thoroughly with conditions throughout the plant, and the accident prevention measures in other plants, and prepared recommendations for improvements. With this approved data, and the backing of the executives, he was in a position to proceed with the inauguration of a safety program that would meet with the co-operation of the entire plant.

The principle of management support cannot be over-emphasized. Safety is actually an executive responsibility, and should be administered by a man reporting to the operating head of the plant. Otherwise men in the shops, concentrating on production, and believing that if they boost safety they will sacrifice output and get in wrong with the management, will take no interest in the movement. The safety director was given the responsibility for the work of improvement, and was backed up by the general manager. The superintendents of the mills instructed foremen to co-operate in the safety plans. The safety director could order work done to guard dangerous conditions, or remove obstructions likely to cause injuries. Employees began to be on the lookout for dangerous conditions, and the careless men were watched and warned. Bulletins, accident records, and safety displays all helped to drive home the principles of safety. As a result of the new methods, planned and put in effect late in 1925, the total number of lost time accidents in 1926 decreased 69 per cent from the number in 1925, and the general labor department engaged in loading and unloading materials and in construction, had no lost time accident in 15 months. —Samuel Davey, *Manufacturing Industries,* October.

Standard Bolt Heads and Nuts

(Continued from sheet 14a)

The width across flats of standard machine screw and stove bolt nuts in $\frac{1}{4}$ to $\frac{1}{2}$-in. sizes is $1\frac{1}{2}$ D + $\frac{1}{16}$ in., with adjustments in the 16th-in. sizes to eliminate 32d-in. size wrench openings. The maximum width across the rounded corners of the hexagon equals 1.14 times the minimum width across the flats. The minimum width across the rounded corners of the square equals 1.373 times the minimum width across the flats.

The width across flats of the standard castellated nuts shown in Table 10 is minus (0.015 D + 0.006). The minimum width across corners equals 1.14 times the minimum width across flats. The nuts are washer faced, the thickness of the washer face being $\frac{1}{64}$ in. The thickness of the nut is the distance from the top of the castellated nut to the bearing surface. The tolerance on the diameter of the washer face is plus or minus 5 per cent.

Table IX—Hexagonal and Square Machine Screw Nuts and Stove Bolt Nuts

Diameter of Screw D	Width Across Flats		Width Across Corners of Hexagon,	Thickness	
	Maximum	Minimum	Minimum	Maximum	Minimum
No. 0	0.1562	0.150	0.171	0.050	0.043
No. 1	0.1562	0.150	0.171	0.050	0.043
No. 2	0.1875	0.180	0.205	0.066	0.057
No. 3	0.1875	0.180	0.205	0.066	0.057
No. 4	0.2500	0.241	0.275	0.098	0.087
No. 5	0.3125	0.302	0.344	0.114	0.102
No. 6	0.3125	0.302	0.344	0.114	0.102
No. 8	0.3437	0.332	0.378	0.130	0.117
No. 10	0.3750	0.362	0.413	0.130	0.117
No. 12	0.4375	0.423	0.482	0.161	0.148
$\frac{1}{4}$	0.4375	0.423	0.482	0.193	0.178
$\frac{5}{16}$	0.5625	0.545	0.621	0.225	0.208
$\frac{3}{8}$	0.6250	0.607	0.692	0.257	0.239

Table X—Castellated Nuts

Diameter of Bolt D	Width Across Flats		Minimum Width Across Corners	Thickness Nominal	Slot	
	Maximum	Minimum			Width	Depth
$\frac{1}{4}$	0.4375	0.428	0.488	$\frac{9}{32}$	$\frac{5}{64}$	$\frac{3}{32}$
$\frac{5}{16}$	0.5000	0.489	0.557	$\frac{11}{32}$	$\frac{3}{64}$	$\frac{3}{32}$
$\frac{3}{8}$	0.5625	0.551	0.628	$\frac{13}{32}$	$\frac{1}{16}$	$\frac{1}{16}$
$\frac{7}{16}$	0.6250	0.612	0.699	$\frac{29}{64}$	$\frac{1}{16}$	$\frac{1}{16}$
$\frac{1}{2}$	0.7500	0.737	0.840	$\frac{9}{16}$	$\frac{1}{8}$	$\frac{3}{16}$
$\frac{9}{16}$	0.8750	0.860	0.980	$\frac{33}{64}$	$\frac{5}{32}$	$\frac{3}{16}$
$\frac{5}{8}$	0.9375	0.922	1.051	$\frac{39}{64}$	$\frac{5}{32}$	$\frac{1}{4}$
$\frac{3}{4}$	1.1250	1.108	1.263	$\frac{11}{16}$	$\frac{5}{32}$	$\frac{1}{4}$
$\frac{7}{8}$	1.3125	1.293	1.474	$\frac{25}{32}$	$\frac{5}{32}$	$\frac{1}{4}$
1	1.5000	1.479	1.686	1	$\frac{5}{32}$	$\frac{1}{4}$
$1\frac{1}{8}$	1.6875	1.665	1.898	$1\frac{5}{32}$	$\frac{7}{32}$	$\frac{5}{16}$
$1\frac{1}{4}$	1.8750	1.850	2.109	$1\frac{1}{4}$	$\frac{7}{32}$	$\frac{5}{16}$
$1\frac{1}{2}$	2.2500	2.222	2.533	$1\frac{1}{2}$	$\frac{7}{32}$	$\frac{5}{16}$

Table XI—Open End Wrench Openings

Basic Width Across Flats, Bolt Heads and Nuts	Clearance	Tolerance	Dimensions of Measuring Blocks for Wrench Openings	
			Maximum	Minimum
$\frac{5}{32}$	0.1562	0.0014	0.005	0.163	0.158
$\frac{3}{16}$	0.1875	0.0016	0.005	0.194	0.189
$\frac{1}{4}$	0.2500	0.0018	0.005	0.257	0.252
$\frac{5}{16}$	0.3125	0.0019	0.007	0.321	0.314
$\frac{11}{32}$	0.3437	0.0022	0.007	0.353	0.346
$\frac{3}{8}$	0.3750	0.0024	0.007	0.384	0.377
$\frac{7}{16}$	0.4375	0.0025	0.007	0.447	0.440
$\frac{1}{2}$	0.5000	0.0030	0.007	0.510	0.503
$\frac{9}{16}$	0.5625	0.0035	0.007	0.573	0.566
$\frac{5}{8}$	0.6250	0.0040	0.007	0.636	0.629
$\frac{3}{4}$	0.7500	0.0050	0.008	0.763	0.755
$\frac{13}{16}$	0.8125	0.0050	0.008	0.826	0.818
$\frac{7}{8}$	0.8750	0.0050	0.008	0.888	0.880
$\frac{15}{16}$	0.9375	0.0055	0.009	0.952	0.943
1	1.0000	0.0060	0.009	1.015	1.006
$1\frac{1}{8}$	1.1250	0.0070	0.010	1.142	1.132
$1\frac{1}{4}$	1.2500	0.0070	0.010	1.267	1.257
$1\frac{5}{16}$	1.3125	0.0075	0.011	1.331	1.320
$1\frac{1}{2}$	1.5000	0.0090	0.012	1.521	1.509
$1\frac{11}{16}$	1.6875	0.0095	0.013	1.710	1.697
$1\frac{7}{8}$	1.8750	0.0100	0.013	1.898	1.885
$2\frac{1}{4}$	2.2500	0.0120	0.015	2.277	2.262
$2\frac{5}{8}$	2.6250	0.0140	0.017	2.656	2.639
3	3.0000	0.0160	0.019	3.035	3.016
$3\frac{3}{8}$	3.3750	0.0180	0.021	3.414	3.393
$3\frac{3}{4}$	3.7500	0.0200	0.023	3.793	3.770
$4\frac{1}{8}$	4.1250	0.0220	0.024	4.171	4.147
$4\frac{1}{2}$	4.5000	0.0230	0.026	4.549	4.523

The sizes given in Table II for the maximum and minimum are the sizes of Go and Not Go gage blocks used for inspecting wrenches, and are not the product sizes. All standard wrenches are now marked only with the basic width (maximum width of the nut) across the flats as shown in the first column. This standard simplifies wrench marking.

Manufacturers' Standards

The manufacturers' standards for bolt heads and nuts, as adopted by the Bolt, Nut and Rivet Manufacturers Association, are based upon the standards of the American Engineering Standards Committee, but the $\frac{5}{8}$ and $\frac{3}{4}$ in. regular square and hexagon nuts, listed in Table V, have been made $\frac{1}{16}$ in. wider than these standards in order to permit the use of hot-forged nuts, and the $\frac{9}{16}$-in. size is $\frac{1}{64}$ in. thicker in order to permit the use of the United States Standard $\frac{1}{2}$-in. material for this size.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Accidents and Purchasing Power

WHILE the cost of accidents, both to the men and to the industries in which they are employed, is well understood, the effect of these accidents on the purchasing power of the individual or of the community of which he forms a part is generally overlooked. Reports from the automotive industry, for example, indicate an increase in the number of accidents in their plants. The actual number shows some increase and the severity of the injuries was greater than in any recent year.

Accidents mean loss in production due to temporary idleness of the machine equipment and the excitement that invariably attends them. They also mean suffering and financial loss to the worker. But beyond that they mean a direct and substantial lowering in purchasing power that amounts to far more than we realize. Money that has been laid aside to purchase a new car, radio, clothing or household equipment, goes to hospitals, doctors and nurses. It represents an economic waste because its use in restoring earning and producing capacity should not have been necessary.

Labor forms the great bulk of our markets for average commodities. Its earning capacity should be conserved in the interest of its purchasing power as well as for its own sake.

The New England Conference

JUDGING from the spirit shown at the third New England Conference, the industrialists and business men of that important section of the United States are well on the way to overcoming two of their handicaps—an inferiority complex and an unjustified self-sufficiency. These two handicaps sound paradoxical, but are they?

Few New Englanders will admit to an inferiority complex but it takes only a little digging to discover it. They have watched their competitors in other parts of the country adopt new methods, buy the latest and best in equipment and undersell them because of lower production costs. They themselves have let their inferiority complex, or mistaken idea of thrift, or whatever you choose to call it, lead them to believe that they could not afford the latest in equipment.

As to self-sufficiency, that is not to be wondered at in businesses that are now directed by the third and fourth generation after the founders, or by trustees of estates. Although there are conspicuous exceptions the trustee is likely to be too conservative and the great grandson too luxuriously reared to be willing to do the hard thinking and bold departing from traditional ways charactistic of the pioneer type.

That concerted effort is beginning to overcome these handicaps is the most encouraging news that has come from New England in many a year. There is not the slightest reason why it should not succeed and bring New England back into the running if New Englanders will pull together and exercise the ingenuity and industriousness for which their forefathers were famous.

Citizens of other parts of the country will be wise to watch the progress of New England and to see to it that too much success does not lull them into a condition from which they can only extricate themselves by similar struggles.

Favoring New Customers

ONE of the mistakes common in all lines of business is the neglect of old customers for new. The desire to add a new name to the list of those using our product blinds us to the desirability of retaining the good will of those on whose patronage we have built up our business.

Railroads spend thousands of dollars to induce the occasional traveler to use their trains, probably but once, and at a greatly reduced rate. But the steady customer, the commuter, who pays thirty days in advance, month after month, receives scant attention.

The landlord refuses to make even minor repairs and decorations for Mrs. Jones, who has paid rent regularly for several years. Yet if Mrs. Jones leaves, he immediately fixes the place up for a new tenant.

It is much the same with builders of machinery or machine products. The new customer gets better service and occasionally even a better price. The new order receives precedence in the shop and the old customer is likely to be sidetracked, the manager depending on his good nature to keep him from changing his source of supply.

However great the temptation may be to cater to the new customer, it is well to remember that it is a dangerous game to play. If you once lose the old customer from such a cause he is likely to be a hard man to regain.

Shop Equipment News

Cincinnati "Giant Hydromatic" Automatic Milling Machines

RECIPROCATION of the table of the pipe through the reversing the "Giant Hydromatic" milling machines recently developed by the Cincinnati Milling Machine Company, Cincinnati, Ohio. Among the operating characteristics obtained are: reciprocation in either direction at normal feeding rates or at rapid traverse rate; positive control of the feeding movement regardless of the direction or amount of the resultant cutting force; positive lock of the table in the stopped position, thus rendering it incapable of movement under the action of the cutter; the ability for accurate reversal under any cutting conditions; readily controlled acceleration and deceleration of the feed rate during a cut; and economical operation. Two views of the standard unit are shown in Figs. 1 and 2, while Fig. 3 shows a duplex model.

These operating characteristics have been obtained by the use of a special combination of pump and auxiliary devices arranged to provide a locked control system. In Figs. 4 and 5, the standard hydraulic feed pump unit is shown, while Fig. 6 shows in simple diagrammatic form the arrangement of the elements involved in the feeding circuit only. Cylinder *C* is securely bolted to the bed and carries a sliding piston *P* connected to the table by a substantial piston rod. Part *V* is a reversing valve, and *B* a small high-pressure booster pump that works in conjunction with the Oilgear variable-displacement pump to produce a continued forward pressure on the piston. The amount of the pressure is determined by the setting of the relief valve *R*. The space within the cylinder on both sides of the piston is at all times completely filled with oil; consequently, in order that the piston may be moved in a given direction by means of the forward pressure, it is necessary that the oil on the other side be able to escape.

If no escape is permitted, there will be no movement of the piston. If some escape is permitted, then the piston will advance just as fast as the escaping oil will allow it, and, with a positively controlled escapement, the rate of advance is virtually independent of the amount of forward pressure applied.

From Fig. 6 it is evident that the only avenue of escape for the oil from the rear end of the cylinder is by way of pipe *D* through the reversing valve and thence through the Oilgear pump. Consequently, the quantity of oil permitted to escape from the cylinder is definitely fixed by the displacement of the Oilgear pump. As the displacement of this pump may be varied at will from zero to maximum, the forward rate of the table may likewise be varied. With this system a constantly receding restraint, or back pressure, is provided.

The amount of this back pressure is not constant but varies with the direction and amount of the resultant cutting force. The circuit described above pertains to a movement of the table at feeding rates only. In order to provide, in addition, a high table feed for rapid approach to the work and rapid return, use is made of an auxiliary large-volume, low-pressure gear pump. This is connected in the same circuit as the feed and is operated by a common control or selector valve. This valve is arranged to give both a reversal of table movement and a change of speed from feed rate to rapid traverse, or vice versa. The valve has both reciprocatory and oscillatory motion.

In addition to the feature of flexibility of feed control indicated above, many other advantages of this type of feed are cited by the manufacturer. Due to the fact that it is possible to change the feed rate during the cut, it is possible to arrange a simple cam to adjust the feed rate automatically to the amount desired where the piece to be milled is not uniform throughout its length. Longer cutter life, high efficiency of metal removal, safety, and simplicity are also featured.

With a chip of any practical thickness, there is a continued succession of plastic deformation with a consequent crystal elongation and work hardening shear, and under practical cutting conditions, the resulting load variations occur at exceedingly high rates; consequently, the actual instantaneous force variations on the

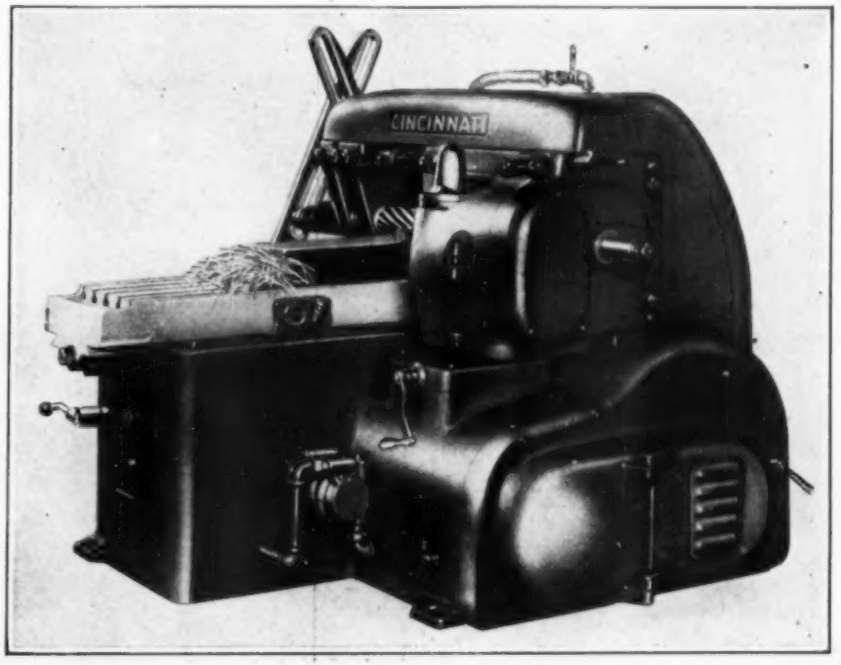


Fig. 1—Cincinnati "Giant Hydromatic" Milling Machine, showing location of the driving mechanism

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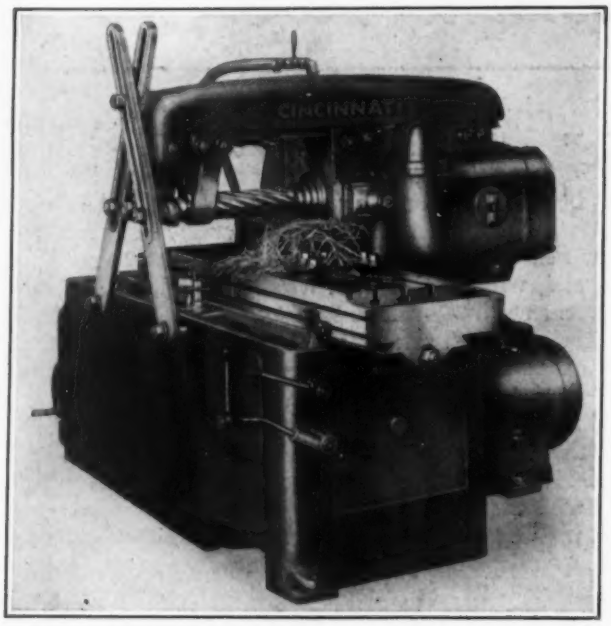

Fig. 2—Operating position of the Giant Hydromatic

cutting tool will be greatly influenced by the character of the mechanism sustaining the work in opposition to the cutter. With a hydraulic feed mechanism, owing to the compressibility of the oil, yielding can take place and hence the peak loads do not rise to a high value. Furthermore, since the slight leakage constantly occurring throughout the system is a function of the instantaneous pressure, such momentary increases of pressure as do occur tend to increase the leakage momentarily. Thus there is never a complete return to the system of the energy stored in the yielding members. The impact caused by the teeth coming into action is also reduced. As a result, the cutter life is increased.

As regards safety, the entire feeding transmission is automatically safeguarded against overload by the action of the various relief and control valves. Simplicity is also obtained. The elements used comprise the rotor and pendulum of a standard Oilgear pump, a small booster pump of simple construction, a high-grade gear pump, and the necessary control valves. External piping has been practically eliminated and the various interconnections are made chiefly by drilled holes through the various parts. As can be seen in Figs. 4 and 5, all three pumps, together with the control valve and auxiliary mechanism are compactly arranged in a single casing, the lower part of which forms an oil reservoir. This unit is attached to and forms the closing member of the rear portion of the main bed structure of the milling machine. Two pipe unions form the only connection between the unit and the table cylinder. The spindle drive is through a motor, inclosed in the base, to a primary drive shaft by means of a silent chain. This primary shaft carries a multiple-disk friction clutch and a set of bevel gears for changing the direction of spindle rotation. These members constitute a self-contained unit provided with splash lubrication. One of the bevel gears in the reverse mechanism is used as a driver of the vertical shaft from which, by means of a set of reduction bevel gears, the change gears are driven. These change gears are mounted solidly on the shaft by means of a steep taper and a locking nut to facilitate their removal when necessary. The secondary change-gear shaft also carries the back-gear pinion from which a large face gear is driven. This entire mechanism is lubricated by means of an oil pump continually circulating oil over all bearings and gears.

All shafts, including the spindles, run on Timken roller bearings. The standard Cincinnati, four-bearing, self-compensating spindle mounting is featured. The drive is designed to keep the high speed transmission as close to the spindle as possible. The change gears are mounted directly on the face-gear pinion shaft to provide rigidity with a minimum of torque whether the spindle runs in a right- or a left-hand direction.

The housings that carry the spindle driving unit are of generous dimensions and of box-type section, heavily ribbed. These housings are particularly designed to minimize all deflections under the cutting load. The lower compartment contains on one side the motor and on the other side the preliminary driving units such as the multiple-disk friction clutch and spindle reverse mechanism. The upper part carries the spindle carrier, supported by large surfaces and a narrow guide.

The spindle carrier is a self-contained unit in which the whole gear transmission, including the spindle speed change gears are mounted. This unit also carries the large quill that provides for the lateral adjustment of the cutter. The quill is made of high-carbon steel, heat-treated, and its adjustment is made through a self-locking worm and rack. It is rigidly clamped in the spindle carrier around its full

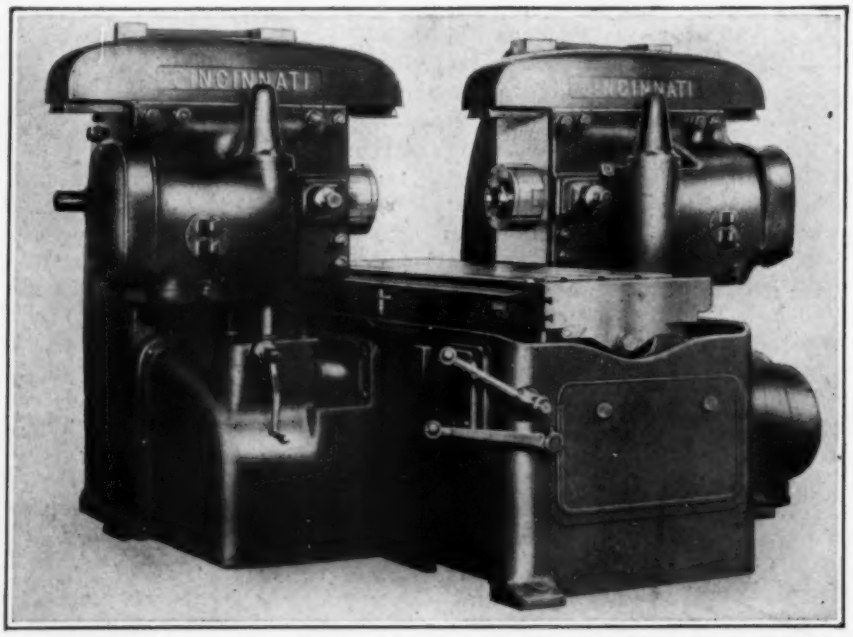

Fig. 3—Duplex Model of the Hydromatic

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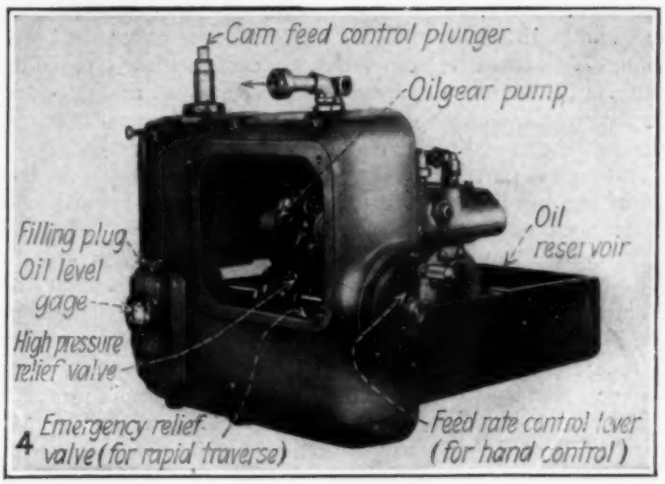

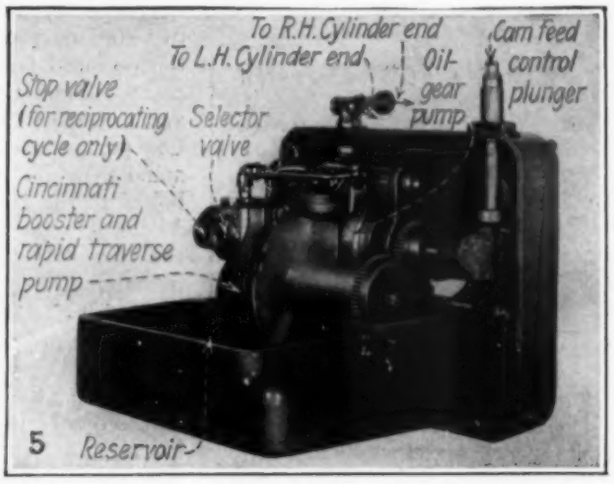

Figs. 4 and 5—Inside and outside views of the standard hydraulic feed unit

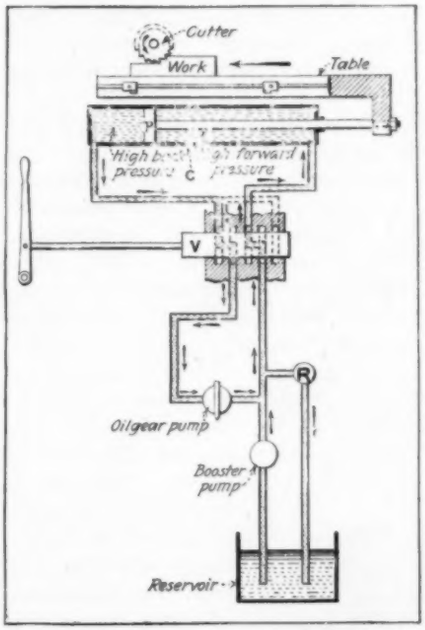

Fig. 6—The hydraulic feed circuit in diagrammatic form

diameter by one bolt. On top of the spindle carrier is mounted the standard Cincinnati rectangular overarm, featuring great strength, self-alignment, ease of longitudinal adjustment, and quick mounting of the overarm brackets when arbors are used.

The table is mounted directly on the bed, which is of new design. This Giant Hydromatic milling machine, on account of its great chip-producing capacity, was especially designed to take care of these chips, and also the large amount of cutter coolant necessary. The portion of the bed that carries the table is of tubular cross-section and is made integral with the side walls by cross bridges of oval section. These bridges, while having ample strength, are spaced far enough apart to allow free passage of the largest chips falling from the table into the bed. The chips accumulate in a chamber underneath the table and a door at the front end of the machine allows for their quick removal. A large strainer is placed inside of the bed and it provides ample means for the coolant to return to its reservoir even if chips completely cover the strainer. The design of the bed is such that splash guards can readily be applied to confine the coolant within the table area. As mentioned before, the rear end of the bed carries in a separate chamber the self-contained hydromatic feed unit with its pump and accessories.

The table bearings on the bed are the full width of the table and of sufficient length so that the overhang of the table in its extreme positions never exceeds one-fourth the table length. The table itself is of standard Cincinnati construction, designed for rigidity.

All operating levers are conveniently located at the working position. A starting lever operates the friction clutch, which has an integral brake for stopping. A second lever controls the feed mechanism and has four positions: two positions result in power rapid traverse in either direction of the table, while the other two positions give feed to the table in either direction. The position of this lever indicates the direction in which the table moves. A third lever stops and starts the table movement.

The automatic control of the table is similar to the one used on mechanically-operated Cincinnati automatic milling machines. Dogs set on the table operate a single plunger with oscillatory and reciprocating movement that controls the valve of the hydraulic feed mechanism. Any cycle of milling, either a one-way feeding cycle with automatic quick return or a reciprocating cycle automatically controlled for fast and slow feeding in either direction, can be obtained. Means are also provided so that the spindle can automatically be stopped on the return movement of the table.

Adjustments for setting up the machine such as raising and lowering the spindle carrier, and in and out adjustment of the quill are made from one position. All bolts for loosening and tightening the various elements can be operated with a single wrench in the same position, thus facilitating adjustments.

The machine can be furnished with a flood lubrication system for applying coolant to the cutter. In this case, a centrifugal pump delivering 20 gal. per min. is used.

These Giant Hydromatic milling machines are built as plain and duplex machines in a number of sizes varying in table travel from 36 to 72 in. and in table width from 16 to 24 in. The corresponding weights of these machines vary from 9,500 to 18,000 pounds.

Frew Oval Chuck

Oval or elliptic work can be handled in an engine lathe with the attachment, shown in the illustration, manufactured by the Frew Machine Company, 124 West Venango St., Philadelphia, Pa. The device can be used for turning punches dies or

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Frew Oval Chuck applied to an engine lathe

similar work and for a wide variety of special jobs.

The chuck is set for the required ratio between the two diameters of the ellipse by sliding a block, tongued to a stationary piece, and bolting it in the required position. The chuck is easily applied to any lathe having a swing not less than that of the chuck. One part is threaded to the end of the spindle, while a stationary part is bolted to the front of the headstock. The work can be strapped either to the faceplate or a chuck can be mounted thereon to hold the work.

The chucks are built in three sizes, 12, 16, and 18 in. The maximum capacity of the 12-in. size is an ellipse $5\frac{1}{2}$ x $8\frac{1}{2}$ in.; that of the 16-in. size, an ellipse 8 x 12 in.; and that of the 18-in. size, an elipse of 10 x 16 in. The chucks are carefully made and all rubbing surfaces are carefully scraped.

Waltham Improved Thread Milling Machine

AN IMPROVED model of thread milling machine was recently placed on the market by the Waltham Machine Works, Waltham, Mass. In Fig. 1 it is shown mounted on a cabinet base having a door and two shelves for holding tools and attachments and an angle plate for holding the motor. The machine is also furnished in a regular bench model. In either case a coolant reservoir is contained in the tray and a removable screen is used to collect the chips. In Fig. 2 it is shown equipped for relieving.

The bench model is furnished with a countershaft for drive. For either type of drive, however, the driving lever is attached to the front of the reservoir base.

The work may be held either by a spring chuck, jaw chuck, or on centers. The tailstock has a cross adjustment for aligning centers or for work having a slight taper. The cutter head is mounted on an angle iron that may be swiveled horizontally to an angle of 35 deg. in either direction, as well as vertically. This feature is said to be useful in giving cutting clearance when milling buttress threads. The cross slide has a lever for withdrawing the cutter and returning it to its original position without altering its setting.

A main shaft at the back of the machine drives the cutter, the work, and an oil pump. It runs at constant speed and may be belted to either a wall countershaft or the motor. Sixteen changes of speed for the work are provided. A simple indexing device is attached to the work spindle and an index with twelve divisions is furnished for miscellaneous work.

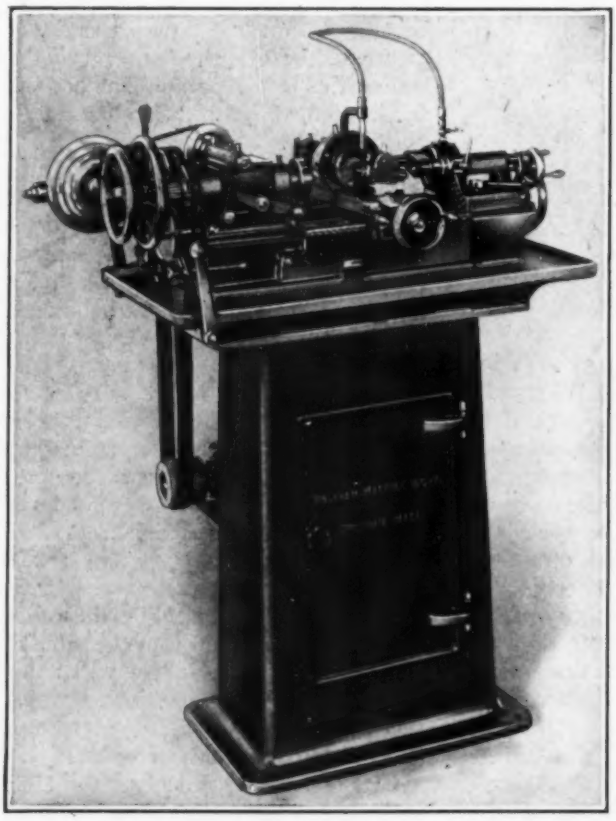

Fig. 1—Waltham Improved Thread Milling Machine

Two kinds of taper attachments may be obtained; one called the plain taper bar, connects with a cross-slide carrying the cutter head and operates similar to taper attachments used on chasing lathes; the other, or compound taper bar, consists of a bar pivoted at the middle and free to swing within a space controlled by stop screws. To mill taps part straight and part taper, or with two angles of taper, the pivoting point is placed opposite the point where the change in angle is desired, and the spring pressure of the cross-slide then automatically swings the bar from one stop to the other, when the travel of the carriage carries the cross-slide past the pivoting point. A screw-adjusted swivel compensating bar, connected by a lever to the nut of the lead screw, provides means for varying the lead to allow for changing or correcting leads.

For relieving taps of multiple-threading cutters, the regular work head is replaced by one that carries a cam mounted on a shaft geared to the work spindle. The machine so equipped is shown in Fig. 2. A set of change gears that will provide for milling any number of lands, from three to ten inclusive, is furnished, and by means of extra gears, all divisions from eleven to twenty may be obtained. The cam is connected by levers to a throw-back mechanism which controls the movement of the cross-slide carrying the cutter head. The compound taper attachment described above is also included with this outfit. The cam is mounted on a faceplate graduated to 100 divisions, thus affording means for adjusting the position of the relief in relation to the flute and for changing the position for each cut for spiral-fluted multiple cutters.

For external or internal milling, using a multiple cutter, it is desirable to use

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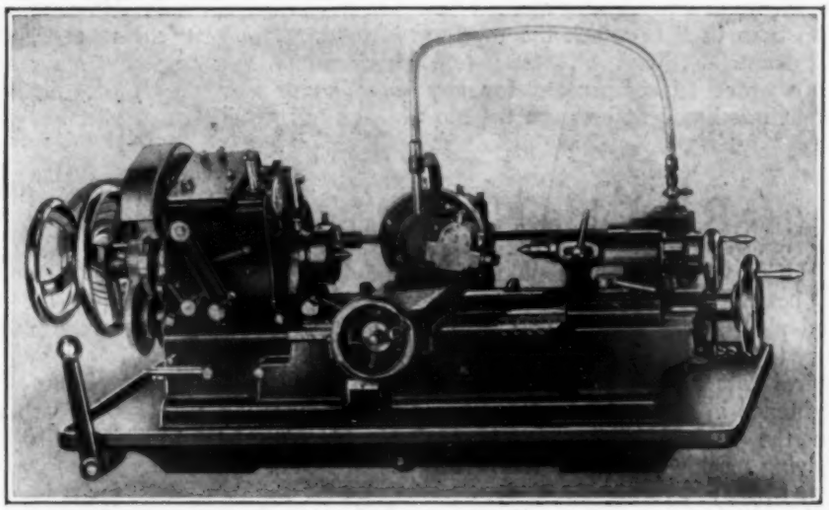


Fig. 2—Bench-Type Thread Milling Machine equipped with relieving attachment

small diamond cutters and a strong spindle. For this purpose, a compact cutter head, screwed directly to the cross-slide, has been designed. Another special cutter head using the same spindle and drive as the one just mentioned may be used for helix angles of 40 deg. or more or for long lead work. In this case, a special tailstock is required. The special tailstock can also be provided for long slender work.

The regular work drive is through a worm and gear on the work headstock and is satisfactory for a lead ½ in. or shorter. For longer leads it is necessary to apply the power through a lead screw and this is done by attaching a special bracket carrying a worm spindle which engages with a gear on the lead screw. The worm and gear are brought into mesh by the regular hand lever that starts the machine. This gearing is disengaged automatically at the end of the cut.

Work that can be milled by using the multiple cutter and other threads that require but a short movement of the carriage may be economically produced by the substitution of a cam shaft for the lead screw where the production of large quantities is required. This construction makes the machine more nearly automatic as it gives opportunity for the use of a lead cam to return the carriage to the starting position and also for another cam to feed the cutter to the required depth and withdraw it to clear the work when the carriage is returning.

The standard equipment of the bench machine includes a follow rest, one milling cutter, indexing device for cutting multiple threads, and wall countershaft. The lead screw is provided with the regular set of change gears. A set of translating gears to provide for cutting metric figures can be furnished extra. In this case the metric lead screw is also supplied.

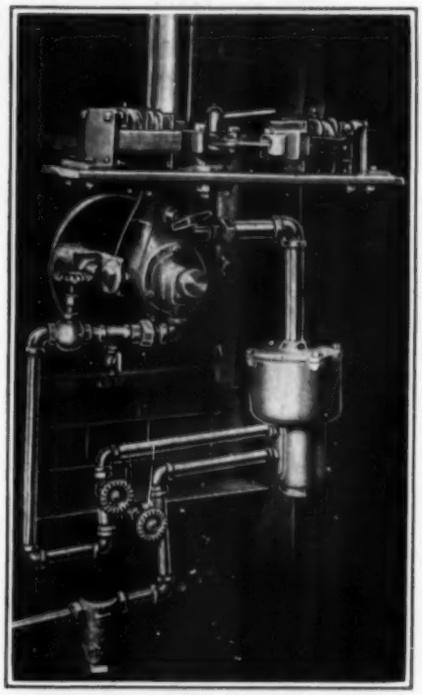
SPECIFICATIONS

Swing over carriage, in.	3
Diameter of work for which machine is best adapted, in.	2
Length of thread cut, work held on centers, in.	8¼
Length of thread cut, work held in spring chuck, in.	10
Extreme distance between centers, in.	12
Dimensions of reservoir base, in.	19x34
Weights of standard equipment, lb.	390
Motor required, hp.	¼
Weight of cabinet base, lb.	270

Mahr-Harris Automatically-Controlled Industrial Burner

Steady operation, close control and uniform temperature at any desired degree of heat are some of the features of the Mahr-Harris automatically-controlled industrial burner, made by the Mahr Manufacturing Company, Minneapolis, Minn. The device is a combination of control units with the standard Mahr triple-atomizing-type industrial burner. In addition to the automatic control features the device provides an additional factor of safety: It is so designed that, if for any reason the air supply fails, which would be the case if a fuse is blown out, or if the blower stops, or if an air line should break, this control would instantly shut off the flow of oil to the burner.

As an automatic control device it may be operated either with a three-point or two-point control. In other words, it may be so set that it will operate the burner at high, low or normal settings, or, if desired, it may



Mahr-Harris Automatically Controlled Industrial Burner

be set to operate the burner in full-on and entirely-off positions.

The principle of construction provides positive control. The air valve setting at either high, low or normal is accomplished by electric magnets. When the air valve is closed or opened, the air pressure in the burner body is reduced or increased. This change in air pressure immediately and automatically adjusts the fuel valve setting through a special siphon diaphram arrangement in the fuel balancing valves. There is no lag in operation due to the adjustment of the air valve obtained in the manner described.

The oil control unit may also be used to balance the burners on opposite sides of a double-end furnace. For example, in a forging or other industrial furnace having burners on two sides, it is possible to adjust not only the air, but also the oil supply to both sides of the furnace by the adjustment of one single air valve in the oil control unit. Under such cir-

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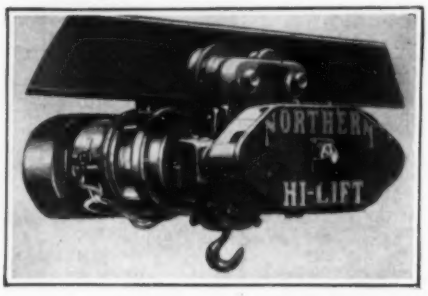
cumstances both burners would balance in operation.

The Mahr-Harris automatic control industrial burner is made in sizes that will cover a range of temperature from the very low temperature required for core baking to high temperatures required for forging or welding.

Improved Series of "Hi-Lift" Hoists

Several improvements have been made in the line of "Hi-Lift" hoists made by the Northern Engineering Works, Detroit, Mich. Compact design, rigid construction, ready accessibility and high efficiency in operation, together with high hook lift, are some of the features stressed by the manufacturer. The hoists are furnished in one- or two-motor design.

The hoists are mounted on plain I-beam trolleys and have corner collectors. They are provided with two



Improved "Hi-Lift" Hoist

brakes, a motor check brake attached to the end of the hoist motor armature shaft, and a mechanical brake in the hoisting gear train. This is a positive type friction-disk ratchet brake, similar to that used on other hoists made by this company.

Another feature is the one-piece unit casting used to maintain alignment. This casting is arranged so that the shroud fits over the ends of the drum, thus preventing the hoisting rope from passing over the ends of the drum. The hoist is suspended by a substantial cast-steel hanger piece.

The load hook is capable of being pulled up within 14 in. from the underside of the beam to the center of the hook. Two stops are provided at both limits of travel of the load block. The downward movement of the load block is controlled by a spring which is released after the last layer of rope is off the drum. A new method has also been used to attach the rope to the drum.

In order to compensate for any slight misalignment between the motor and gear train a flexible coupling is used. The gear covers are split horizontally, so as to permit ready inspection or removal of the gearing without disturbing other parts.

Reynolds Nut-Driving Machine

SUCH work as the assembling of bearing caps, valve bonnets, motor end plates, connecting rods preparatory to reaming, or any work that requires nuts or caps to be driven and tightened in pairs, can be performed on the Reynolds two-spindle nut-driving machine, made by the Metalwood Manufacturing Company, 3362 Wight St., Detroit, Mich. In Fig. 1 a complete view of the machine is shown, while in Fig. 2 details of the drive mechanism of the machine are indicated.

The machine is equipped with a substantial column rising from a base of such area that there is no overhang of any part. In the rear of the column is a vertically-adjustable motor bracket carrying a 2-hp. constant-speed motor. Countershaft drive is optional equipment. The belt from the motor passes over idler pulleys to a driving pulley at the top of the machine. The lower end of this drive shaft supports a magnetic clutch. The driven end of the clutch is carried on a bronze casing containing a differential of special design by means of which the two spindles are driven. One spindle is driven directly from the differential as shown and the other through a quill gear and idler gear. This second spindle is mounted in a slide which is adjustable across the column to permit the spindle being set at any desired center within a range which varies from $2\frac{1}{6}$ to 6 inches.

The lower end of the spindle carries a detachable socket wrench in which the nut or cap screw is placed and held magnetically. Below the spindle there are ways on the column on which rides a bracket having a vertical motion controlled by a foot lever. This bracket is adapted to receive a table or fixture to carry the parts being assembled. On the side of the column and near the top is a mechanical switch operated through an epicyclic gear train and driven from each side of the magnetic clutch. The function of this switch is to open and close the magnetic clutch circuit at the proper time. Below the work bracket and convenient to the operator is a rheostat in the magnetic clutch circuit.

In operation the nuts or cap screws are placed in the socket wrenches, which are at rest, and the parts to be assembled are placed in the fixture in line with spindles. The pedal is depressed as the work bracket moves upward. A swinging cam closes a contact switch, thus energizing the magnetic clutch and starting the spindles in motion. As the pedal is further depressed the nuts or screws are driven to a tightness determined by the adjustment of the rheostat. When the magnetic clutch starts to slip, the mechanical switch opens the clutch circuit, thus releasing all torque on spindles and allowing the work to be freely withdrawn from the wrenches by releasing the pedal. The operation is then repeated.

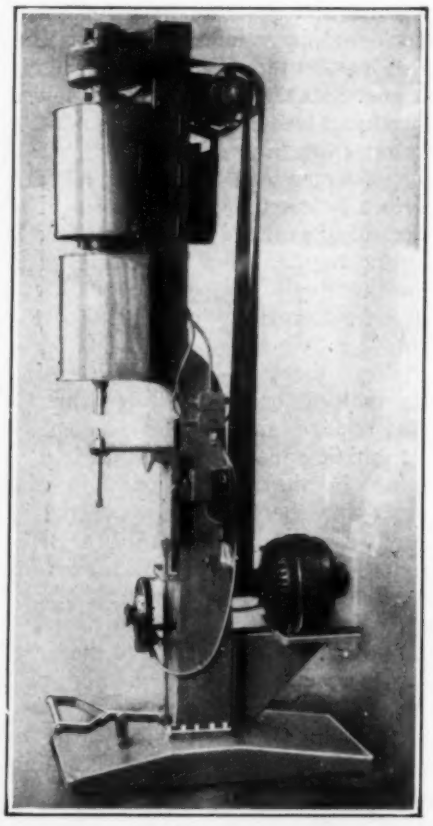


Fig. 1—Reynolds Nut-Driving Machine

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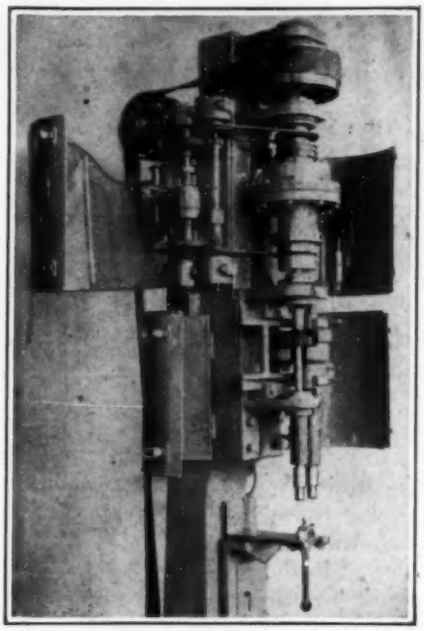


Fig. 2—Close-up view of the drive mechanism

If one of the nuts or screws should begin to tighten before the other, the differential slows down or stops this one and speeds up the lagging one until both nuts are of equal tightness, when both proceed at the same rate until both obtain the tightness to which the machine is adjusted.

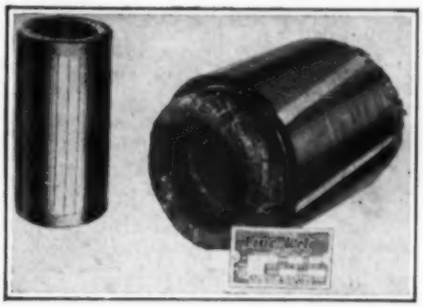
The spindles and gears are made of alloy steel, heat-treated, and the spindles are ground after being hardened. Every rotating part except the slow moving epicyclic gear is carried on high-grade ball bearings. The spindles run at approximately 500 r.p.m. so that the operation is quite rapid.

Lincoln Shell-Type Motor

A squirrel-cage motor for use in various kinds of woodworking machinery and all other machinery requiring high-speed motors has been placed on the market by the Lincoln Electric Company, Cleveland, Ohio. This motor is of the so-called shell type, of all-welded design, and is made to the standard dimensions of the trade. It is supplied in two sizes, 3 and 5 hp. One of the sizes is illustrated.

The 3-hp. unit has an external diameter of 6½ in. and an external length of 4½ in. The 5-hp. motor is of the same diameter, and is 6 in. in external length. Both motors are manufactured for either 2- or 3-phase, 60-cycle current, and have a rated speed of 3,600 r.p.m. The stator is composed of laminated sections arc-welded together. The welding is done while the shell is under pressure, and is placed in six transverse slots. The rotor is also entirely arc-welded, and is provided with either a straight or tapered bore.

Several advantages are claimed for the welded construction: The welding does away with the necessity of a solid shell about the laminations, and also replaces the conventional rivets. Thus, the amount of active field is kept at a maximum. The effect of this is to increase the magnetic flux and allow more copper to be used in the slot. As a result, better operating characteristics are obtained, together with cooler running conditions because of the increased amount of copper.



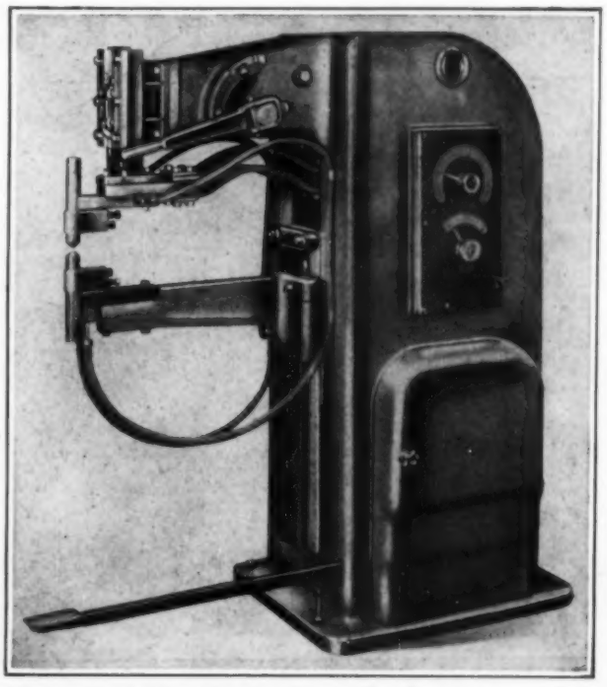
Lincoln Shell-Type Motor

As normally used, the stator is secured in the frame of the machine, and the rotor is mounted on the tool shaft. If desired, the stator can be supplied with 6-ft. leads.

Thomson Model 275 Power-Driven Spot Welder

POWER drive is featured in the Model 275 spot welder made by the Thomson Electric Welding Company, Lynn, Mass., and shown in the accompanying illustration. It has a capacity for welding two pieces of iron or steel of No. 10 gage or slightly heavier, depending on the speed of operation. The maximum pressure on work at the die points is approximately 600 lb. This pressure is adjustable by means of a spring mounted on the cam-operated pressure lever.

The power unit consists of a 1-hp. motor and a train of spur gears. It is located in the base of the welder and the main driving shaft has a cam which, through connecting levers, controls the movement of the upper welding electrode. The cam is arranged to give a die opening of approximately ¾ in. An auxiliary upper die lift is provided for by means of a lever located on the right-hand side of the neck of the welder frame. With this construction, 2 in. of additional lift of the upper die is available so that work having ribs or flanges greater than ¾ in. can be inserted or removed. The control of the unit is by a treadle. One depression of the treadle results in a complete cycle of operation. If the treadle is depressed and held down, the operation becomes continuous. A re-



Thomson Model No. 275 Power-Driven Spot Welder

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mote control switch or wall contactor is supplied with the welder, the operation of which is controlled through a rotating switch mechanism mounted on the power drive unit. This switch is adjustable to permit obtaining long or short periods of welding current flow to suit welding conditions. The welder may be furnished with four sets of change gears designed to give welding speeds of approximately 40, 60, 80 and 100 strokes or welds per min., depending on the thickness of the material to be welded and the nature of the work.

The horns are 24 in. in length and the lower horn is arranged to permit a drop of either 12 or 24 in., as required. Solid or water-cooled, hard-drawn copper dies 1½ in. in diameter are used. The die holders are also water cooled.

The transformer is rated at 35 kw. or 58 kva. The core is of the double-window shell type. The secondary is of cast copper and is water cooled by means of seamless steel tubing cast integral with the secondary. The primary coils have taps connected to a regulator mounted on the frame of the welder and ten points of variation are available.

The unit occupies a floor space of 28x74 in. and is 75 in. high.

Adams No. 5 Gear Hobber and Thread Miller

ALTHOUGH designed primarily for the hobbing of spline shafts and the hobbing or milling of screws and worms, the No. 5 gear hobber and thread miller recently built by the Adams Company, Dubuque, Iowa, is also readily adaptable to the production of small spur and helical gears. Fig. 1 shows a general view of the machine. The base is of one piece and heavy box construction and incorporates a trough for the collection of chips as the coolant passes through into a reservoir.

Power is derived from an electric motor in the base, controlled by a reversing switch and push button. The motor is easily accessible from the front door. The drive includes a multiple-disk clutch, with a sliding gear transmission driven from the motor through a silent chain. This transmission provides eight cutter spindle speeds varying from 70 to 350 r.p.m. The pick-off gears give 39 standard feeds. As shown in Fig. 2, these gears are housed in a built-in rack at the end of the machine.

A balanced head drive is used to impart smooth power to the cutter spindle. This drive is mounted on double-row ball bearings of ample load-carrying capacity. The location of the head is such as to permit chips

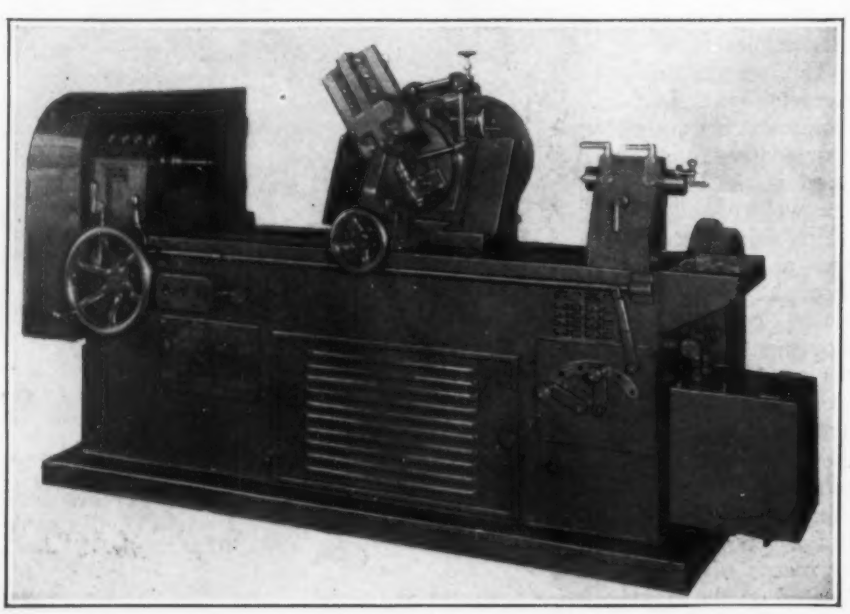

Fig. 1—Adams No. 5 Gear Hobber and Thread Miller

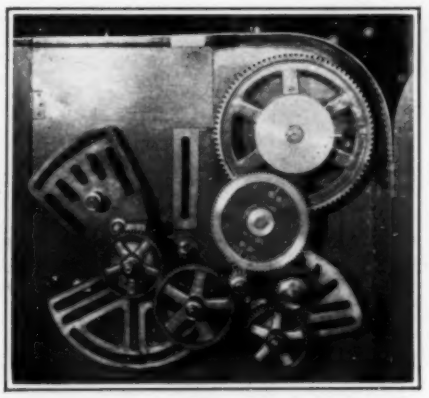

Fig. 2—Index and feed gear arrangement

to drop free and a liberal supply of coolant is available for cutting steel. A handwheel controls the vernier setting of the head to the required angle, while the depth of the cut is also controlled by a handwheel at the front of the cross-slide. Near these handwheels are the other controls, centralized for convenience.

Particular attention has been paid to the lubrication of the machine. The head mechanism operates in grease, while all other bearings and gears are lubricated by the Madison-Kipp fresh oil system.

Heat-treated alloy steel gears are used throughout, with the exception of the pick-off feed gears. At the left in Fig. 2 are shown the index gears and to the right the feed gears. The herringbone gear drive to the headstock spindle can also be seen. The index plate shown is used when milling multiple-threaded worms or screws.

This machine will accommodate work up to 10 in. in diameter and 48 in. between centers. It will take work 3 in. in djameter through the hollow spindle. A special headstock can be obtained for 5-in. bar work.

Forbes & Myers Improved Frequency Changers

Brushes, collector rings and all insulated windings of the rotor have been eliminated in this simplified frequency changer made by Forbes & Myers, 172 Union St., Worcester, Mass. Units are available in sizes ranging from $\frac{1}{10}$ to 3 kva. The unit will convert 2- or 3-phase, 60-cycle current of any voltage into 1-, 2- or 3-phase current of 180 cycles at any voltage. It is possible to change the

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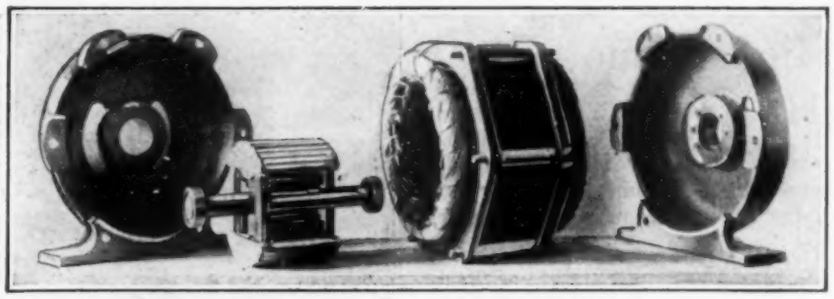


Forbes & Myers Simplified Frequency Changer

voltage and phase at the same time as the frequency.

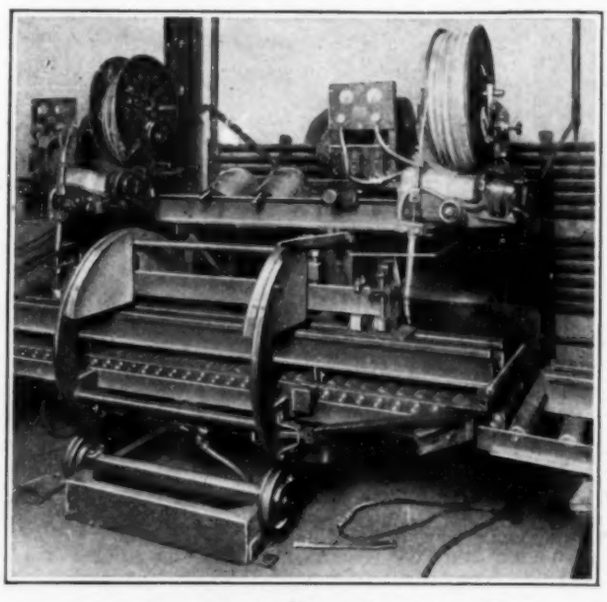
The construction of the frequency changer is similar to that of an ordinary induction motor. The stator has two windings: a two-pole winding, which is connected to the 60-cycle current; and a six-pole winding, which delivers the 180 cycle current. Both these windings are similar to the windings of an ordinary induction motor, and both are placed in the same slot and in the same core.

The rotor differs from that of an ordinary induction motor, however, in that two opposite sections are cut away, leaving but two-thirds of the usual rotor core. Bars and rings are used to carry the current. The frequency changer delivers exactly three times the frequency of that of the current used. After it once comes up to speed, there is no reduction in frequency on account of load. Even when short circuited, the frequency remains the same.

The unit is particularly recommended for use in operating high-frequency tools, such as small grinders and drills.

General Electric Metal Railroad Tie Welder

AUTOMATIC welding equipment for making metal railroad ties from scrap rails is announced by the General Electric Company, Schnectady, N. Y. These metal railroad ties are simple in construction and can be made in this machine at a low cost.



General Electric Metal Railroad Tie Welder

The welding apparatus developed for this work consists of an automatic tie-welding machine and a 1,500-amp. motor-generator set with two circuits for hand welding and two circuits for automatic welding. There is also the following equipment: A section of a roller conveyor on which the rails are moved into position for welding; a jig for correctly spacing the rails and locating the tie plates on top of them; two pneumatic plungers for rigidly holding these parts in position; a pair of spring- and toggle-operated clamps for holding the angle irons against the ends of the rails; a mechanism that rotates the whole jig with its rails and plates; two automatic welders mounted on individual travel carriages for welding the two tie plates simultaneously; a track on which the travel carriages ride; and a supporting framework. The jig can be turned in either direction a distance of 45 deg. from the vertical so that welding can be done first on one side of the tie plate and then on the other.

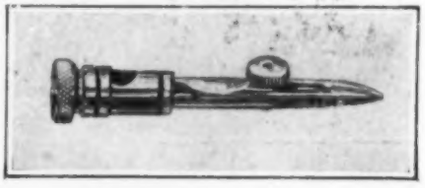
Each metal tie consists of two lengths of worn or scrap rail cut to length and held together at both ends by angle bars which are welded to the rails. The rails are further held by two tie plates welded to the top or head of the rails at the point where the track work is clamped to the tie.

The rails are inserted in the machine and the tie plates placed in position. The equipment is then fixed in position by means of compressed air. Next, the angles are placed in position, after which the work is rotated to a point where the joints between the plates and one rail may be welded automatically. The fixture is then rotated to a point where the other joints are beneath the electrode and the welds are made again automatically.

While these automatic welds are being made, the operator welds the angles to the ends of the rails by hand. For maximum production the machine requires two operators, one for each of the two automatic heads. Each head has a separate control panel so that each operator is largely independent of the other. The estimated output of the machine with two operators is one tie in every five minutes.

Brown & Sharpe Pen Attachment

The Brown & Sharpe Manufacturing Company, Providence, R. I., announces a pen attachment for use with its universal divider No. 843 with the No. 845 steel beam trammels. The knurled handle from a trammel can be screwed in a tapped hole in the pen attachment. This attachment is well made and is useful for enabling the draftsman to draw accurate circles, arcs and fillets.



Brown & Sharpe Pen Attachment

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Chambersburg High-Frame Guided-Ram Hammers

LARGE working space is featured in the high-frame steam hammers made by the Chambersburg Engineering Company, Chambersburg, Pa. The unit is recommended for forging large disks and rings, for upsetting high stems, forming arch bars, and for long punching with drifts. In Fig. 1 the entire unit is shown.

The cylinder is a special iron casting and features self-drainage and deep stuffing boxes. It is held to the frame by body-bound bolts and is fitted with a patented safety cover and safety valve. Because of the drainage feature, it is impossible to operate the hammer with water trapped at the bottom of the cylinder. The throttle valve is of the rotary type and the operating valve, Fig. 2, is ground into a removable case. This operating valve is a balanced piston type and has a screw stem with fixed nuts to preserve its alignment. It is actuated by a cam on the ram incline without any fixed connections.

The construction of the guides and shoes is given in Fig. 3. The guides are made of semi-steel and are supported on five sides by the frame. A steel adjustment wedge has a bearing the full length and width of the guide. The adjustment is by bolt and spool supported by the frame and removable without removing the guides and shoes. The guides can be adjusted without removing the ram. The ram is an open-hearth, annealed steel forging and is set at an angle to the frame. The rod is also an open-hearth, annealed steel forging and is formed solid with the piston. The piston rings are of a narrow type and are made of steel. They can be examined or removed without removing the rod from the ram. All stuffing boxes can be tightened or packed without disturbing any other parts, and for greater accessibility, the piston gland is made in halves. The cylinder gaskets are protected and are seated in a tongue and groove joint. The standard anvil weighs 7½ times the falling weight. It consists of an iron anvil and cap, and a cast-steel die and keys. For extremely long work the die fits a notch in the anvil base.

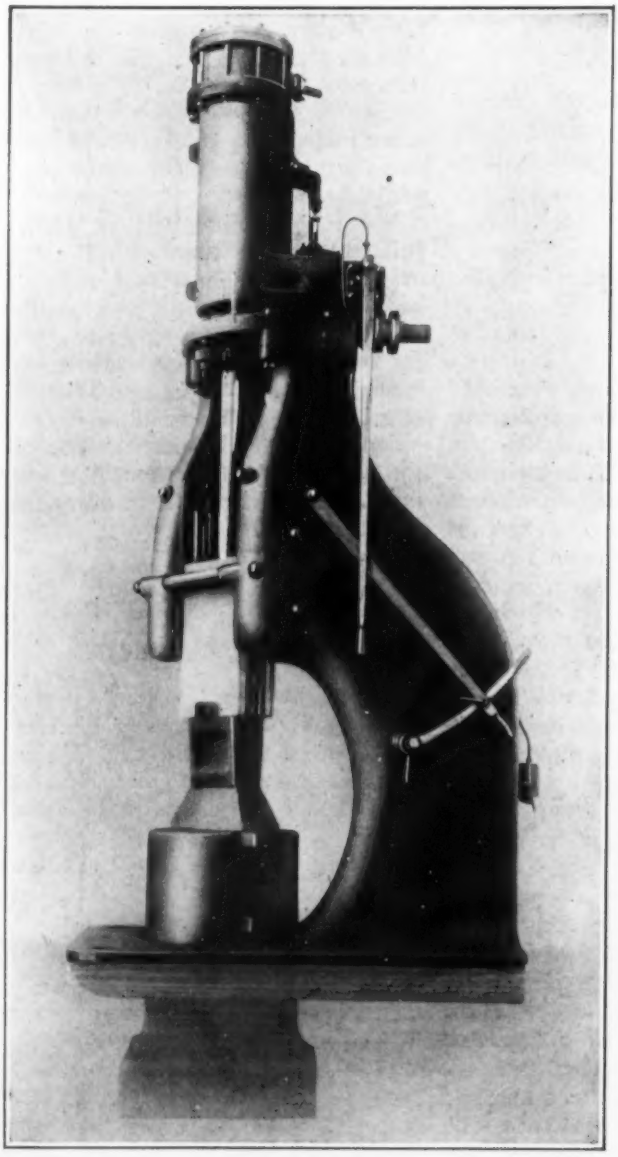

Fig. 1—Chambersburg High-Frame Guided-Ram Hammer

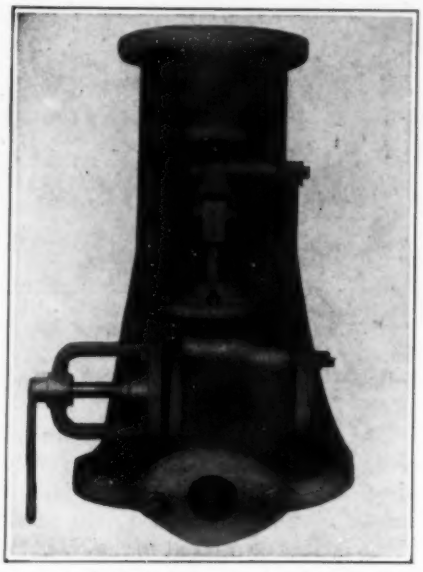

Fig. 2—Throttle and operating valves

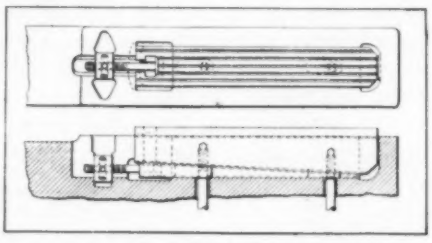

Fig. 3—Cross-sectional view of the guide construction

The standard equipment includes one pair of hard-face, cast-steel dies, a hand-operated oil pump and steam and exhaust nipples.

These high-frame hammers are made in nine sizes designated by the total weight of the ram, the die and the piston rod. These sizes vary from 700 to 6,000 lb. The cylinder bores range from 7 to 21 in. in diam. and the stroke from 23 to 48 in. The corresponding minimum die spaces are fixed at 6x11½ in. and 12x21 in.

Globe-Wernicke Filing System for Drawings and Maps

Increased life and usefulness of a drawing is claimed by the use of the filing system recently developed by the Globe-Wernicke Company, Cincinnati, Ohio. There is no contact between adjacent sheets and no fric-

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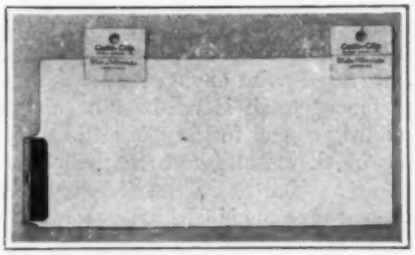


Fig. 1—Clip used in the Globe-Wernicke Filing System

tion when pulling out or tucking in a sheet. It is unnecessary to thumb the corners of the sheets when searching for a specific drawing, so that frays, folds and dog ears at the corners are avoided. The clip suspension is particularly suited for paper, Ozalid and Van Dyke prints.

The nucleus of the system is a clip shown in Fig. 1 composed of a strip of celluloid inclosed in india rubber adhesive cloth. One end of the clip is attached by adhesion to the drawing. The other end contains a hole and slit that permits suspending the sheet by snapping the clip over horizontal rods. Two or more clips are used per sheet and the sheets are strung on an assembly of polished rods that are mounted in cabinets or in open racks as shown in Fig. 2.

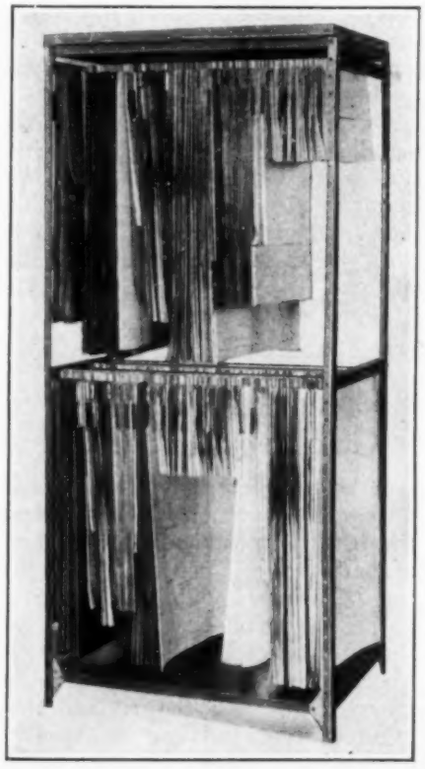


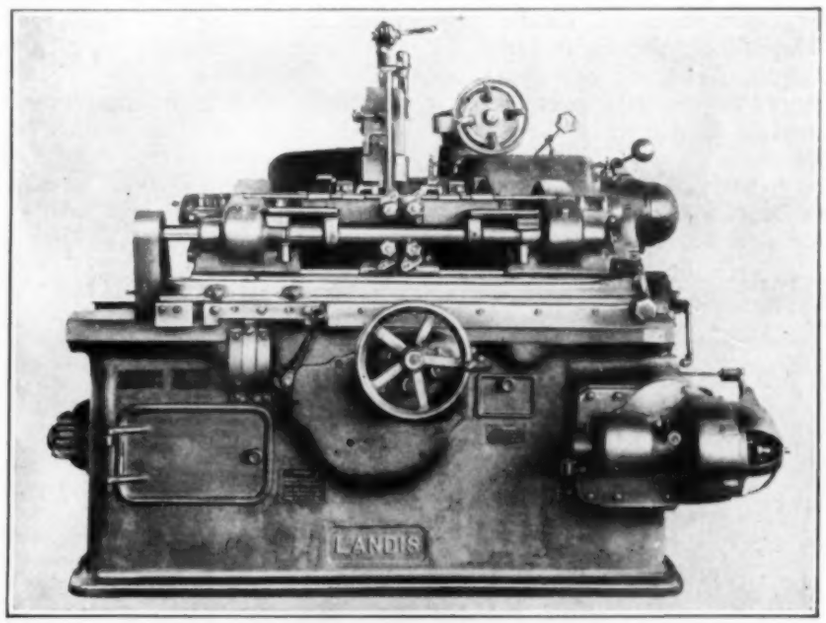
Fig. 2—The open-rack type of Globe-Wernicke File

Mounted on the assembly of polished rods are a set of six riders made of ply wood. These riders enable the contents of the rack to be shifted laterally, to gain access for the removal of a drawing.

The clips also serve as handles to the drawing, and it is not necessary for the hands to come in contact with the sheets. Guide cards are distributed along the rod assembly to produce a visible index. Numerical guides with green and yellow angle tabs are used to form a numerical index, and the location of specific drawing or subdivision of the file are marked by guide cards with orange angle tabs. All sheets are visible and equally accessible regardless of the size of the sheet, and any sheet may be referred to without removal from the file.

Landis 10-Inch Hydraulic Crankpin Grinder

FOR the production grinding of the pins of small motorcycle, refrigerator, or stationary engine crankshafts, the 10-in. hydraulic crankpin grinder shown in the illustration has been especially developed by the Landis Tool Company, Waynesboro, Pa. The machine is made in a 10x16-in. and a 10x32-in. size.



Landis 10-Inch Hydraulic Crankpin Grinder

The operation of the machine is simple: On double-throw crankshafts, such as the one shown in the machine in the illustration, the two end pins are ground first. The operation is simply a truing out from the rough forging, each end of the pin being supported with a work rest, and a spacing bar being called into play. When the center pins are ground, a locating bracket is attached to the right-hand head, the spacing bar is changed, and the work rests are moved to the two center pins. The use of a locating bracket enables the operator to get the inside pins on center quickly before clamping the work in the carrying fixtures, while the spacing bar gives him facilities for speedily positioning the work carriage with relation to the pin that is to be ground.

The work is driven from both ends. Power for the work drive is applied from the rear drive through a belt and several sets of silent chains. Quickly-operating mechanical clamps hold the work in accurately ground clamping blocks. Rotation of the work, which is at 100 r.p.m., is controlled by a single lever at the front.

The grinding head is massive, and

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is equipped with a special alloy-steel spindle, hardened and ground. This spindle runs in bronze cap bearings lubricated under pressure. A grinding wheel 30 in. in diam. is used.

Rapid hydraulic power infeed to the grinding wheel head is featured. The wheel moves toward the work at high speed until it starts to grind, at which point it automatically slows down to the predetermined grinding feed, and continues to move in at this rate until it comes against a positive sizing stop. Movement of the wheel away from the work is at rapid traverse speed. Convenient levers control the direction and speed of the feed. A hand feed, similar to the one used on previous Landis grinders, is also provided.

Power for the hydraulic wheel feed is furnished by a geared pump driven from the rear drive shaft. A portion of the base of the machine is used as a container for the oil.

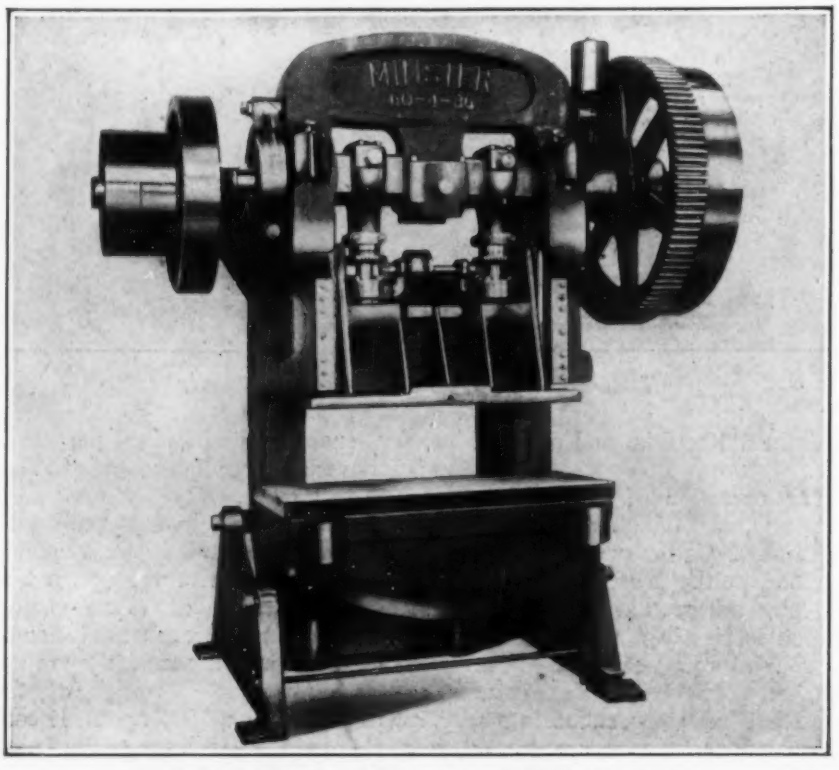
The work carriage is traversed by hand, and back gear arrangement is used to give a slow speed for trueing the grinding wheel.

This machine may be arranged for either lineshaft or direct motor drive. In the latter case, the motor is direct connected to the rear driveshaft through a flexible coupling. In the former, an adjustable countershaft with tight and loose pulleys is provided, and the drive is through a single belt to an auxiliary drive bracket mounted on the bed of the machine.

"Minister" Double-Crank, Open-Back Inclinable Presses

THREE sizes of double-crank, open-back presses designed for strength, variety of operations, and continuous production were recently placed on the market by the Minister Machine Company, Minister, Ohio. Due to the variety of operations that can be handled on these machines, they are recommended for shops where, on account of limited space, single-purpose presses cannot be installed.

These presses have a ram pressure of 32, 45 and 56 tons, respectively, while their weights range from 5,300 to 13,000 lb. All three sizes can be furnished either with a flywheel or with a back-gear drive. The flywheel type is furnished with two-point engagement and the geared type with three-point engagement. A jaw or block clutch is used. The clutch collar is a steel forging, and the striking block inserts, both in the clutch collar as well as in the clutch wheel or gear, are made of high-grade alloy tool steel, specially heat-treated.



Minister Double-Crank, Open-Back Inclinable Press

The gap has been made deep and the opening in the frame wide to facilitate feeding of work either from right to left or from front to back. Adjustment of the inclination of the press is obtained by means of two telescopic screws connected by bevel gears. The supporting trunnions on the frame are so located that when the press is inclined the height from the floor to the center of the dies does not change materially.

The frame casting is so proportioned that the points subject to the greatest strain are specially reinforced. A high grade of semi-steel is used. Tie-rod lugs are cast on the frame so that steel tie rods may be used to increase the rigidity of this member, if required.

The crankshaft is made of high-carbon hammered steel. The main bearings are wide and well supported, while the pin bearings are proportionately large to take care of the heavy pressure exerted on this member. The entire design is intended to prevent spring and to give unusual rigidity.

As can be seen in the accompanying illustration, the slide is flanged and is quite heavy. The ways are long and accurately machined. The slide is supported in extra-heavy and long gibs which are adjustable to take up wear.

Standard Electrical Tool Company Twist Drill Grinding Attachment

A twist drill grinding attachment for use in connection with its electric grinder was recently added to the line of the Standard Electrical Tool Company, Cincinnati, Ohio. In the illustration the attachment is shown applied to an electric bench grinder with wheels 10 in. in diameter. It is easily interchanged with the regular tool grinding rest and can be quickly mounted in position.

The device is equipped with a graduated micrometer screw, so that

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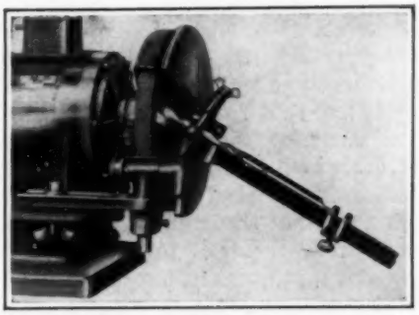
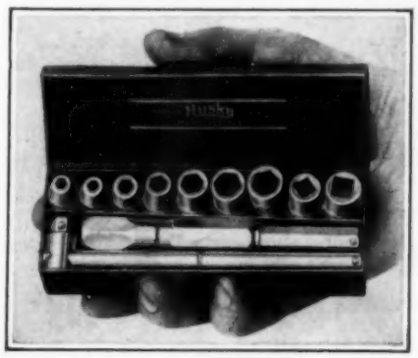


Standard Electrical Tool Company Twist Drill Grinding Attachment

gages are not required. The attachment allows the operator to do such work more rapidly and accurately than by hand. A medium grade of grinding wheel of 60 grit should be used. The attachment is used for grinding either straight- or taper-shank twist drills ranging in size from $\frac{1}{4}$ to $1\frac{1}{4}$ in. It can be furnished for use with wheels up to 12 in. in diameter.

Husky No. 999 "Baby" Socket Wrench Set

A set of socket wrenches for little bolts and nuts, such as are found on carburetors, magnetos, and radio and electrical parts, was recently developed by the Husky Wrench Company, Milwaukee, Wis. This is known as the No. 999 "Baby" Set,



Husky No. 999 "Baby" Socket Wrench Set

and is shown in the illustration. The set has all the features found in the larger Husky wrenches, such as hardened and tapered sockets, long handles, and swivel grips.

The sockets are made to fit the new American Standard bolt and nut sizes. The two small square sockets can also be used for holding small taps with square shanks. The socket sizes are 5/32, 3/16, $\frac{1}{4}$, 5/16, 11/32, $\frac{3}{8}$, 7/16 in. hexagon and $\frac{1}{4}$ and 5/16 in., square. All sockets are stamped with the size of the wrench opening.

The combination T has a self-locking head and a handle 5 in. long with a center groove. The screw driver is $4\frac{1}{2}$ in. long and has a swivel grip to facilitate speedy operation. It can be used with a combination T or with the L-handle.

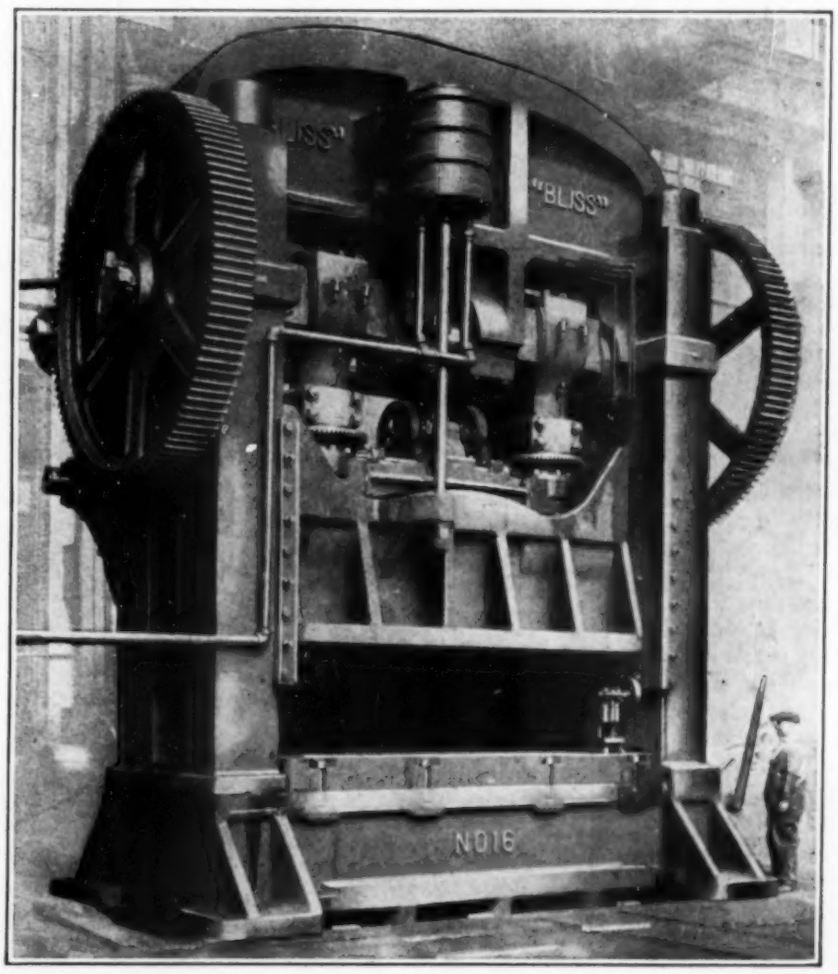
All parts are nickel plated and burnished. The set is packed in a compact and strong metal box.

Bliss Large-Size, Double-Crank Press

WITH a complete weight of over 600,000 lb. the double-crank press shown in the illustration is the largest press of this type that has been built by the E. W. Bliss Company, Brooklyn, N. Y. The crankshaft is 16 in. in diameter at the bearings and 19 in. in diameter at the pins. The small press in the bed of the large one serves in the illustration to give an idea of the size of the larger one.

The press is of tie-rod construction. The entire working strain is taken by four larger steel tie rods which tie together the bed, crown and uprights. The uprights serve to carry the weight of the shaft, gearing, crown and slide. The bed, which is also the largest casting made in this company's foundry, weighs 60 tons. It is of cambered construction. The arch section, which comes below the floor line, is hidden in the illustration of the assembled press, as is also the spring pressure drawing attachment, which fits in the lower portion of the bed. This spring pressure attachment has a capacity of 350 tons. The crown weighs 58 tons, while the slide weighs 34 tons.

The slide is counterbalanced by two



Bliss Large-Size, Double-Crank Press

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air cylinders attached to the crown, one being in front of the machine and the other at the rear. Adjustment of this slide is made by a 15-hp. motor. The machine is twin driven and the ratio of gearing is 50 to 1. Some further details of the press are: Stroke of slide, 15 in.; distance between uprights, 160 in.; area of slide face, 60x148 in.; area of bed, 60x160 in.; area of opening in bed, 48x148 inches.

Niles Improved Horizontal Boring, Drilling and Milling Machine

THERE was recently built by the Niles Tool Works Company, Division of the Niles-Bement-Pond Company, Hamilton, Ohio, a line of entirely redesigned horizontal boring, drilling and milling machines. One of the sizes is shown in Fig. 1. The improvements include a totally-inclosed saddle and drive box with an automatic circulating lubricating system supplying oil to all important gears, shafts and bearings; drive and feed gears of steel throughout; screw feed to the spindle; power rapid traverse to the spindle by a separate motor; more convenient and centralized grouping of controls, and the use of inset scales on the face of the column and ways of the bed. These machines are built in sizes having spindle diameters of 6, 7, 8 and 10 in. The machine illustrated has a spindle 7 in. in diam., with a traverse of 72-in. The spindle is a high-carbon steel forging. It has power feed for drilling and boring. These feeds are reversible and positively driven by gearing and a screw of large diameter. The thrust of the screw in both directions is taken on ball bearings. For drilling and other operations requiring relatively high speeds, the spindle is driven through its sleeve, while for boring large diameters and for milling operations, the drive is through a face-plate gear and pinion. Both hand and power rapid traverse are provided, as well as a fine hand feed. Power traverse is by means of a 1-hp. motor mounted at the outer end of the saddle. When power traverse is engaged, a clutch disconnects the feeding mechanism. Provision is also made for locking the spindle in the sleeve when desired by means of a clamping bushing.

The saddle is an oil-tight box closed by a cover, the removal of which gives ready access to the driving feed gears and other mechanism. A central lubricating system is provided. The oil is circulated to all gears and bearings by a pump, driven by a ¼-hp. motor. The supply of oil may be regulated by sight feed oilers on the exterior of the saddle casting, and a reservoir is built into the base. All drive and feed gears, shown in Fig. 2, are made of steel. The saddle is securely held to the column by square locks and is gibbed inside of the left-hand track of the column. It has reversible power feed for milling and power rapid traverse, as well as hand adjustment for accurate setting. The counterweight for the saddle is at the rear of the column, and slides on rollers.

The column itself is a box casting mounted on a two-track bed, and gibbed inside the left-hand track to a narrow guide. It has reversible power feed and rapid traverse on the bed, as well as fine hand adjustment. The saddle traverse on the column is regularly 96 in., but this may be increased if required. The column traverse on the bed is 120 in., and this also may be extended. Inset scales facilitate measuring the vertical travel of the saddle and the horizontal travel of the column.

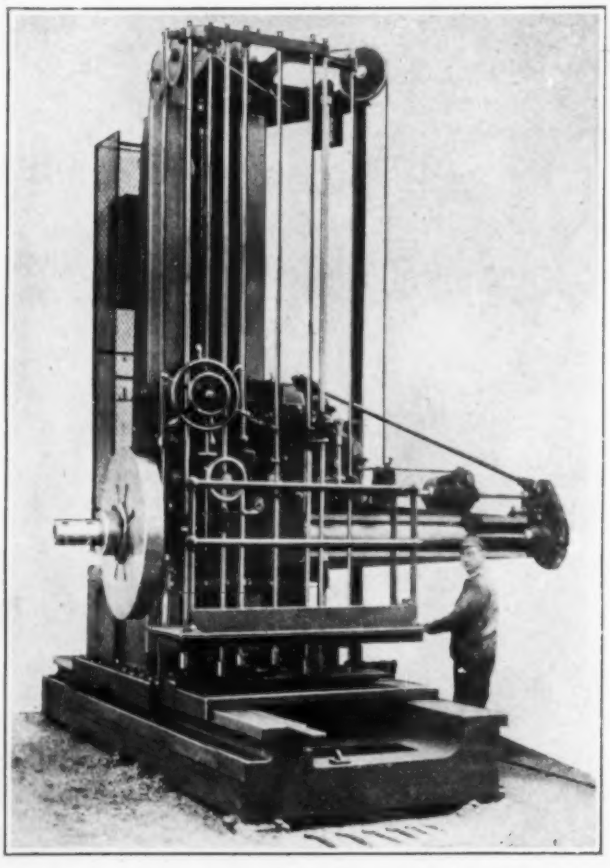

Fig. 1—Niles Improved Horizontal Boring, Drilling and Milling Machine

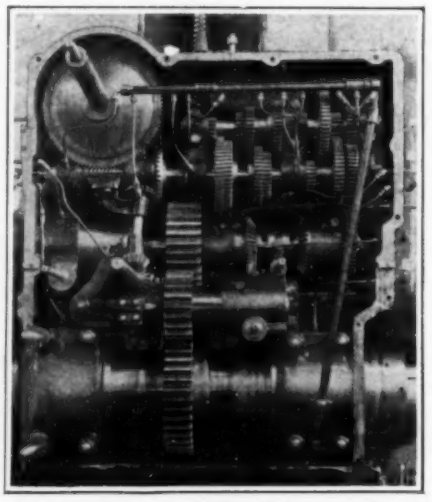

Fig. 2—Gear train and lubricating system in the saddle

The machine is driven by a 15-hp. motor mounted on a gear box at the rear of the column. This gear box, as can be seen in Fig. 3, is totally inclosed. It has a central lubricating system supplied by a pump connected to a ¼-hp. motor, as in the case of the saddle. All drive and feed gears are made of steel. The machine shown is driven by a variable-speed d.c. motor, but the drive may also be arranged for a constant-speed a.c. motor through a gear box having eight mechanical changes of speed.

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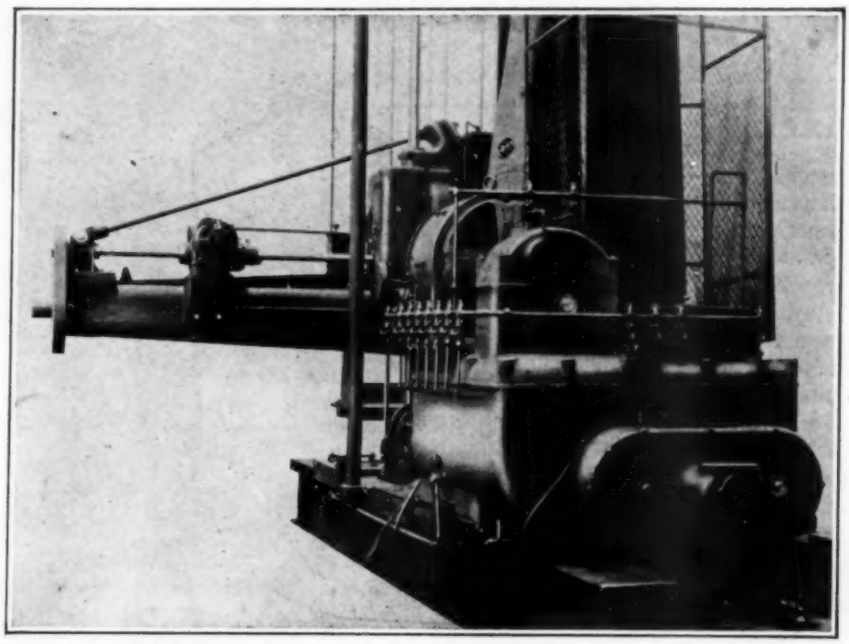


Fig. 3—Rear view of the unit showing gear box and driving motor

All operating levers for the saddle and column are mounted on the saddle and controlled from a platform attached to the saddle and traveling with it. With the machine may be furnished a floor plate bolted to the side of the bed and held in alignment by a planed tongue. This floor plate has T-slots over its entire surface. An outboard column, either plain or mounted on a sub-base is also available. It is fitted with a vertically- or horizontally-adjustable bracket for boring bars. The sub-base, when furnished, is set parallel to the main bed and has screw adjustment on the floor plate parallel with the axis of the spindle. Scales are provided for all movements on the outboard column and sub-base. Circular tables, with either hand or power rotary feed, may also be furnished.

Kent-Owens All-Purpose Iron and Steel Worker

TO MEET the needs of shops having a wide variety of work, the all-purpose iron and steel worker was developed by the Kent-Owens Machine Company, Toledo, Ohio. The various tools provide for punching, cutting and mitering of sections, shearing of round and square bar-stock, and shearing flats and plates. A sinple attachment also provides for coping and notching.

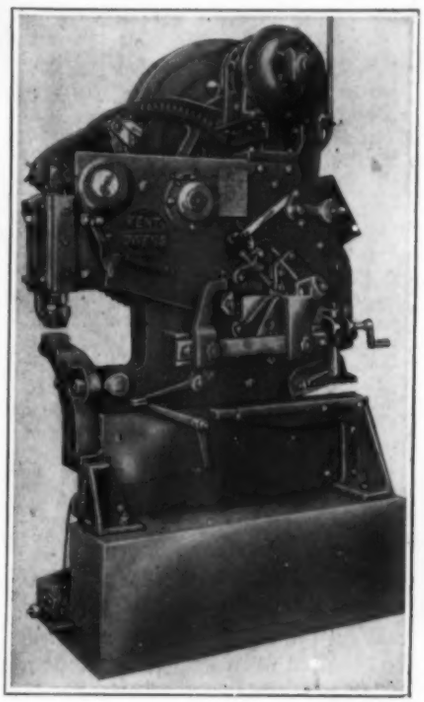
The mechanism is so arranged that the punch may be operated independently of any of the other tools; that is, one operator may be punching holes while a second is either cutting sections or shearing plates.

A feature of the machine is the welded frame construction. The side members of the frame are rolled from special-analysis, open-hearth steel, and are electrically welded to intermediate forgings, placed and shaped so as to provide the maximum rigidity. This welded steel frame not only gives great strength, it is claimed, but also gives rigidity.

The punch is full floating and has an adjustable stroke. It may be brought down to the surface of the work by means of a hand lever, or else the stroke may be set so that it will always come to rest immediately above the work. This feature is particularly convenient when punching material of varying thickness or a large number of holes in material of uniform thickness. The punch and die blocks are so constructed that large clearances are available for punching holes in the web and flanges of I-beams, H-sections, channels and other sections without the necessity of changing the tools.

An adjustable gage is conveniently located for cutting off sections either square or at any desired angle. The bar cutter has an adjustable hold-down plate. Interchangeable upper and lower steel knives, having four cutting edges each, are used in the shear. Because of the welded construction of the frame, large clearance in the shear ways is provided. These ways are free from obstructions, as can be seen.

All bearings are phosphor bronze and lubrication is by the high-pressure Alemite grease system. All slides are counterbalanced to insure smooth and easy operation. The machine may be arranged for motor drive, as illustrated, in which case a



Kent-Owens All-Purpose Iron and Steel Worker

3-hp. motor is recommended, or for belt drive. Steel cut gears are used in the driving mechanism. Operations of the various tools are effected by a simple, positive action clutch.

The capacity of the unit is holes 1 in. in diam. in ½-in. plate; angles up to 4x4x⅜ in., square, and up to 3x3x¼ in. at a 45-deg. angle; rounds up to 1⅝ in. and squares up to 1½ in. in the bar cutter. The shear takes flats and plates up to ½ in. in thickness. The machine may be mounted either upon a concrete foundation or upon a structural-steel box section. The weight is about 3,300 pounds.

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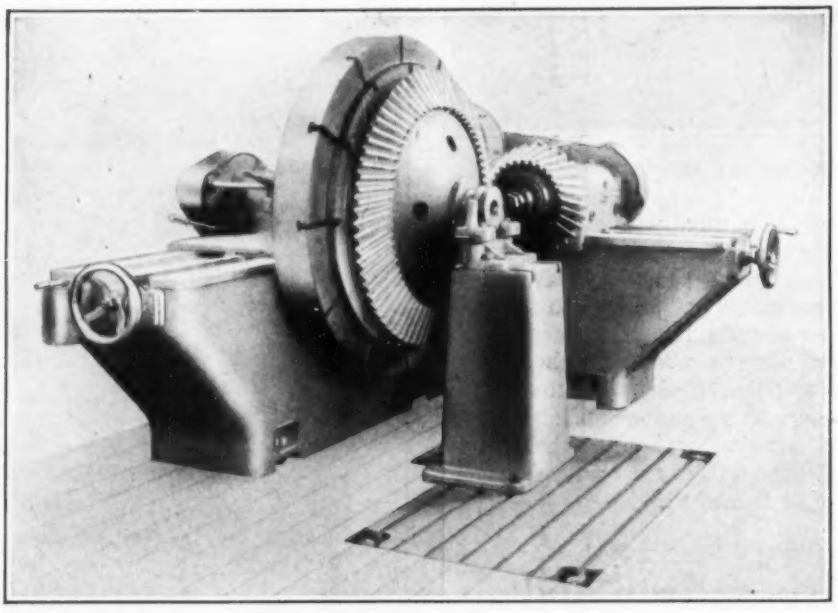
Gleason 90-Inch Bevel Gear Testing Machine

A MACHINE for testing for quietness and proper tooth bearing of bevel gears up to 90 in. in diameter was recently produced by the Gleason Works, Rochester, N. Y. It is shown in the accompanying illustration.

The frame is cast in two pieces, and is firmly bolted and rigidly reinforced. The spindle heads are mounted on slides with a long, narrow guide to give accurate alignment. Rectangular taper gibs take up any wear on the ways, which, in addition, are guarded to protect them from red lead, dust and grit. Each head is horizontally adjusted by means of a handwheel graduated to 0.001 in., and each is held by two clamps.

The spindles are accurately mounted in the same plane and intersect at 90 deg. They are fitted with specially matched ball bearings. There is an oil pocket at each end of the spindle heads with a sight glass to enable the operator to see that the bearings are properly lubricated. The arbors are held in place by draw bolts tightened from the rear of the spindle, and a lock is provided for holding the spindle when the work or arbor is to be removed. A steadyrest, shown in the illustration, is furnished with the machine as an outboard support for heavy gears. It can be adjusted to take care of any size gear within the capacity of the machine.

The machine is driven by a 10-hp. motor mounted on the drive head, and the spindle may be revolved in either direction. A friction brake on the driven spindle permits the operator to test the gears under load.

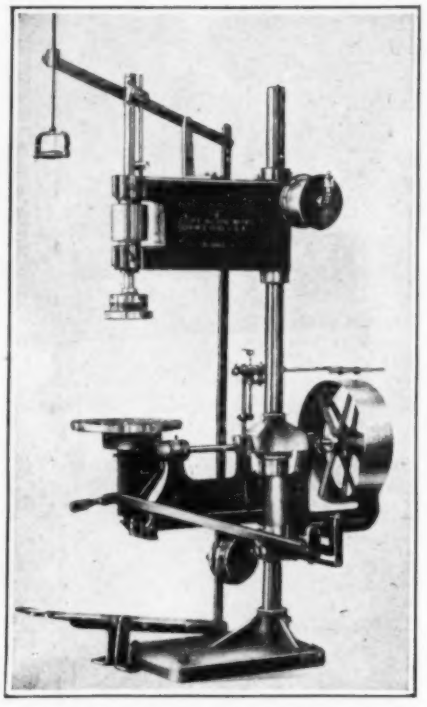


Gleason 90-Inch Bevel Gear Testing Machine

Defiance No. 725 Vertical Grinding and Polishing Machine

FLAT surfaces such as the centers of steering wheel spiders, seats for automobile wheel flanges, and similar work, can be ground or polished on the No. 725 vertical polishing machine with revolving table, made by the Defiance Machine Works, Defiance, Ohio. The machine can also be used as a wood boring machine to bore out the center holes in automobile wheels, and to drill flange bolt holes, if desired.

The revolving table has a planed top 15 in. in diameter, mounted on a swinging arm that can be adjusted off center. It is power driven at a speed to suit requirements. The spindle is 1½ in. in diameter and is made of hammered steel. It travels through a splined sleeve and has 8 in. of vertical adjustment. The maximum distance from the nose of the spindle to the top of the table is 14 in. If the revolving table is dropped to the base a distance of 20 in. can be obtained. The distance from the center of the spindle to the face of the column is 22 inches.



Defiance No. 725 Vertical Grinding and Polishing Machine

The spindle can be fitted with disks up to 10 in. in diameter, having the faces covered with polishing material, or with an expanding chuck, as shown in the photograph, to hold a cup grinding wheel. The spindle can also be fitted with a universal chuck to carry boring bits with ½-in. shanks or smaller. The rate of speed of the vertical spindle is 2,500 r.p.m. This spindle can be raised and lowered either by hand or by treadle, as desired.

The machine is regularly furnished with a separate countershaft complete with a belt-shifting device. Two drop hangers fitted with Hyatt Roller Bearings, one driving pulley, one feed pulley and a pair of tight and loose pulleys for the feed to the revolving table are included. The machine requires 3 hp. to drive. It occupies a floor space of 58x30 in., and weighs 1,000 lb. net.

NEWS OF THE WEEK

Manufacturers and Dealers Would Co-ordinate Supply Bodies

Preliminary plans looking to the organization of a United Mill Supplies Association are taking concrete form in the recent meetings of members of the Mill Supply Council and the executive committee of the American Supply and Machinery Manufacturers Association. It is the intention of the leaders in this movement to co-ordinate the activities and functions of the above trade bodies with the National Supply and Machinery Distributors' Association and the Southern Supply and Machinery Dealers' Association.

At the annual convention of the American association last June, a resolution was adopted urging the segregation of all machinery and supply manufacturers into one association. This would leave the distributors organizations in a better position to merge into the proposed United Mill Supplies Association.

At the meeting of the executive and advisory committees of the American Supply and Machinery Manufacturers' Association, held in New York on Nov. 18, resolutions were adopted which reaffirmed the previous proposals for a united association. That part of the resolution which covers the plan of organization is stated in the following paragraphs:

"We hereby re-assert our function as the sole manufacturer representative of manufacturer-distributor contact in the mill supplies field, and therefore as a just and necessary condition-precedent to a mutually co-operative relationship, we again request the National Supply and Machinery Distributors' Association to give immediate and definite notice of their intention to discontinue their manufacture membership at the termination of their present fiscal year. And we further request our national distributor friends to circulate our views upon manufacturer-distributor co-operation as expressed by our two *Noronic* resolutions, which are hereby made a part hereof.

"In view of the firm conviction of our members, as stated in our *Noronic* resolutions, that only in one parent organization and under a common or neutral management, will real organized manufacturer-distributor co-operation be achieved, we hereby request our president, whenever our council representatives shall deem it wise, to extend a formal invitation to both the National Supply and Machinery Distributors' Association and the Southern Supply and Machinery Dealers' Association to join with us at the end of this fiscal year in the formation of a United Mill Supplies Association on a proper basis of equality for both manufacturer and distributor that will promote and safeguard the best interests of each in the distribution of mill supplies.

Plans Ready for New Engineering Index

In accordance with a previous announcement, the American Society of Mechanical Engineers, will launch, the first of the year, a new and comprehensive Engineering Index service which will be mailed to subscribers weekly. The editor is Joshua E. Hannum, who has recently been engaged in directing the safety and production study of the American Engineering Council. For several years, he has been doing industrial research work and has had considerable experience in indexing, cataloging and abstracting engineering and technical information for the development of special library service in industrial plants. The editorial staff at present consists of C. H. Ullman, who has worked for several years on the old index; I. Gutman, who has prepared abstracts of foreign articles for the old index; M. E. Gardner, a graduate in engineering and formerly with the British Munitions Board, specially qualified to cover machine shop practice, printing industry and mechanical engineering subjects; William C. Marshall, a mechanical and marine engineer of wide professional experience, formerly of the faculty of the Sheffield Scientific School at Yale and Captain in the Ordnance Department, U. S. Army; and William Gretzinger, a mining engineer with wide experience in the oil fields in North and South America. The entire Engineering Index service is under the direction of Major Carlos deZafra of New York University, who has developed the plans.

In order to give prompt service, the society has equipped its own printing shop in the building adjoining the Engineering Societies Building on West 39th St., New York City. In addition to the printing, the distribution and mailing of the service to the subscribers will be done at this location.

Specialty companies are sharing, but to a lesser degree, in the curtailment of the railroad equipment industry this year. Several specialty concerns will, in fact, report better earnings this year than in 1926 owing to their dominating position in their respective lines.

U. S. Foreign Commerce Bureau Brings Profit to Industry

Services rendered by the Bureau of Foreign and Domestic Commerce to Americans engaged in international trade resulted last year in an extra $500,000,000 in profit, Dr. Julius Klein, the bureau chief, stated in his annual report to Secretary Hoover.

The addition to American trading profits came from the procurement of new business by the bureau's representatives and from the prevention of losses by like aid, he said. Only specific items coming under the bureau's notice were included in the compilation.

Dr. Klein pointed to the 2,500,000 calls received by the department last year as an indication of the manner in which the American business man is taking advantage of the aid offered by the department.

Six new domestic branch offices were established last year, and, with the machinery functioning smoothly for the promotion of foreign trade, Dr. Klein said increasing attention was being devoted to domestic business.

Particularly is the bureau being used as an agency for the elimination of waste in distribution, he said, estimating that $8,000,000, or $3,000,000 more than the value of the total export trade, was wasted yearly in distribution.

Four hundred and five firms of a total of 20,640 served have reported that actual sales and savings effected through the bureau's efforts amounted to $9,718,330.

Foreign offices of the bureau are becoming of increasing importance as first points of contact for American business men traveling abroad.

A.S.M.E. Anniversary

The fiftieth anniversary of the American Society of Mechanical Engineers will be celebrated during the week beginning April 7, 1930. This date marks the anniversary of the organization meeting of the society.

While plans for the proposed celebration have not been entirely completed, the tentative arrangement provides concurrently for an international engineering congress of outstanding nature which will not only mark the achievements of the engineering profession for the past 50 years, but will point the way for future growth and development. It is expected that this anniversary meeting will be held in Washington, D. C., thus giving it a national and international character.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

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SIMEON D. FESS, United States Senator from Ohio, made a speech in Chicago last week in the course of which he said:

"Industrial leaders have been concerned about the approach of the saturation point in industry, where production outruns consumption. Unregulated production creates an indisposable surplus. The Secretary of Commerce believes that production can be held within consumption limits by co-operation of leadership in industry. That will stabilize prices.

"Employment of labor at a reasonably high scale of wages stabilizes prices on a high level and insures an increased power of consumption. Under the application of the new 'hand-to-mouth' policy by producing for consumption rather than for storage, the condition of business cycles is avoided."

The Senator is quoted at length for two reasons. One is that he is supposed to be very close to the present Administration. The other is that he has tersely stated the theory upon which the present speculation in the stock market is based and upon which the confident expectation of an early improvement in trade and industry is predicted. Stabilization is a word with which to conjure now. Prices are to be "stabilized" by regulating the supply, and profits are to be stabilized by what the Senator describes as "the co-operation of leadership in industry." "In the non-agricultural world through proper co-operation the cycle of depression can be avoided," the Senator asserted, but he admitted that it would be difficult to avoid depression in the agricultural world without some governmental assistance in financing "crop surpluses."

Assuming that this governmental assistance would be provided, the Senator predicted the indefinite continuance of our prosperity and pictured an economic millenium in which many of his fellow citizens are coming to believe. Upon this belief the stock market has continued to advance. Last Wednesday's business included more issues than have ever before been traded in at a single session, and $300,000 was paid for a Stock Exchange seat, by which is meant the privilege of doing business on the floor.

The speculative enthusiasm manifest is remarkable and the upward movement has acquired an impetus that promises to carry it well beyond the New Year, when the expected trade revival is supposed to be due.

It is to be hoped that the train of prosperity will keep to this schedule, but while we wait it may be well to point out that the proposed plan for regulating commerce and industry does not seem to take any account of consumers and wage earners and that it is possible both may strike if they are not considered.

But this caution may be premature, for the present recession in business has reached a stage from which a recovery would be normal even without stabilization. Thus car loadings for the week ending Nov. 12 were nearly 15 per cent under 1926, and it is estimated that the United States Steel Corporation's present output is only 69 per cent of capacity as against 80 per cent last November, and 83 per cent two years ago.

Cotton goods, for example, are in such poor demand that the manufacturers are considering curtailment, and the effect upon the market for raw cotton has been to prevent the advance which seems to be justified by the latest statistics. Superficially, these conditions would not seem to be encouraging, but the record of the past warrants us in assuming that they represent what is probably the maximum of contraction and that they are likely to be succeeded by expansion.

This probably explains the numbness to bad news that is so noticeable in the stock market, and the susceptibility of the commodity markets to anything of a stimulating nature. Thus rubber advanced quite sharply on a bullish interview with a manufacturer of tires, and wheat has become quite sensitive to even small buying orders.

The sugar trade is also more willing to listen to good news than it was, and copper is up to 13¾ cents upon the expectation that the newly formed Copper Institute will soon undertake to regulate the price of that commodity. Of course the regulation proposed will be effected by limiting the production so that it will not exceed the demand, rather than by reducing the price and thereby increasing the consumption.

Admittedly this is against the canons of economic science, but it may work for a time and until it proves ineffective a somewhat factitious but none the less profitable prosperity is to be expected and will probably ensue. If it comes it will probably continue at least until labor ceases to be fully employed and the reduction in the buying power of the masses compels a constant reduction in the industrial and agricultural output. Therefore good times seem to be indicated for the nearer future, although the long distance view is not quite so reassuring.

WHAT'S DOING IN INDUSTRY

THE PROSPECTS for improvement in machine tool and machinery business stand out as the feature of the present situation in this industry. Current orders in many of the large manufacturing centers are not up to expectations, but there is a general feeling that much of the business pending for the past several weeks will close before the end of the year.

CANADA appears as the most promising source of machinery business, with great activity in steel and railway equipment lines. Eastern New England, recovering slowly from the flood, reports machinery sales holding an even trend. In Western New England spasmodic buying by various users of tools has returned only a fair month's volume. New York dealers report good sales with better prospects for the last weeks of the year. Business continues fairly brisk in the Southern District, the general outlook being better than in some time.

SALES and inquiries are falling off in Chicago, only such tools as are urgently needed being ordered. General activity is holding up in Cincinnati and inquiries are of a better character. There are no immediate signs of improvement in the Detroit territory and little business is being placed at the present time.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CANADA

Machinery and machine tool manufacturers in Canada have been moderately busy during the last two weeks. A healthy volume of small orders and replacement jobs continues. It is expected that a number of large contracts will be consummated before the end of the year.

A marked improvement has taken place in the iron and steel industry. The railroads are in the market almost constantly for equipment or material. The Canadian National Railways recently placed orders for 103 tons steel rails; 91 tons angle bars; 360 tons spikes; 24 tons bolts; 3,018 tons tie plates; 1¼ tons shim spikes; and 10,000 rail anchors for Canadian lines, also 89 tons spikes for United State lines. The orders were divided among the Algoma Steel Corporation, British Empire Steel Corporation, Canada Machinery Corporation, The Steel Company of Canada, and the P & M Company.

Nova Scotia steel plants are beginning to hum, and the outlook is the brightest in years. The British Empire Steel Corporation has finished 8,000 tons of rails for the British Indian government and is ready to roll 10,000 to 20,000 tons for the C. N. R. The Canadian Pacific Railway has purchased a 200-ton wrecking crane and has ordered 20 steel sheathed baggage cars from the National Steel Car Corporation.

The mining industry continues to make heavy demands for tools and equipment. The Horne Copper Corporation has purchased a number of locomotives for switching and underground work at Noranda, Quebec. British Columbia mines have also been in the market for a good volume of tools and machinery lately.

EASTERN NEW ENGLAND

Business in machine shop supplies in the Eastern New England section during the past week appears to be on a par with business in previous weeks. According to representative houses in this section transaction are, if anything, a trifle under the average, but standard articles are holding their own. These houses, however, report that inquiries are more numerous than for some time, although there are few closings.

The machine tool industry in this section seems to be marking time. Business is a little quiet, according to some houses; others report that transactions have made no increase over last week. However, inquiries for heavier tools have shown an increase, but, as in the case of the machine shop supply industry, there are few closings.

Taken as an average, machine tools and machine shop supplies appear to be holding their own, neither increasing nor decreasing in sales.

WESTERN NEW ENGLAND

As a whole, November has disappointed the machine tool industry in the Western New England section in many respects. Spasmodic buying featured the entire month. An occasional dealer reports a better sales volume for November than October, but the reverse has been the rule. Sales of machine tools and machinery are still confined for the most part to single items; and inquiries, though quite sufficient as to number, are not readily converted into orders.

The better side of the picture is featured by an order placed with a Hartford manufacturer by a Detroit automobile manufacturer for several die sinking machines. A Bridgeport fabric machine producer has purchased a lathe from a South Bend concern. A Hartford specialty company has bought tapping and drilling machinery from a Rockford, Ill., manufacturer.

The American Bosch Magneto Corporation, of Springfield, is starting quantity production of ignition sets for the Ford company. Schedules call for the production of 100 sets daily.

SOUTHERN DISTRICT

Distributors of machine tools, mill supplies, etc., state that sales in the last two weeks have failed to show the improvement they had looked for, but that business continues fairly brisk compared with the corresponding period last season, and that the outlook for late fall and early winter sales, judging from the tone of present inquiries and reports from sales representatives in the field, gives promise of at least a normal volume. There are some dealers who believe there will be a considerably better than normal volume in the next few months as high cotton and other crop prices this year have increased the purchasing power of Southern farmers by approximately $300,000,000 compared with the same period last year, a fact which is expected to result in several months of good business for all lines in the South.

As has been the case for several weeks, wood working machinery still leads, and though demand is not as large as it was two or three weeks ago sales are the best they have been at this time of the year in the past four or five years. Demand for contractors' equipment has been declining as building is less active in all parts of the Southeast. Railroads are doing some buying of heavier equipment for shop projects now under way, this volume said by most dealers handling such equipment to be better than last season. Smaller machine shops and garages are buying but little in the machinery line, with most new orders being for used or rebuilt machinery.

CHICAGO

The machine tool market shows little variation from the level that has characterized it for the last several weeks. Orders are being booked in lessening number, if anything, and are principally for single tools. Inquiries have fallen off somewhat, but those being received are of a nature that denote necessity for buying without delay. Railroad buying continues to be limited to such tools as are urgently needed where efficient shop work is demanded. Farm machinery manufacturers are still in the market for additional equipment, and orders from this source have constituted an important factor in recent weeks.

A Chicago representative of one of the big Eastern concerns whose plant produces heavy-duty tools in large volume, after calling on the heads of the purchasing departments of a number of Western railroads, expressed the belief, as a result of his interviews, that railroad buying for 1928 would not be what has been hoped for, and would fall below that of the present year.

Used tools are moving slowly, and business in this line is spotty. Reports in circulation indicate that prices will shortly advance on certain tools, milling machines and lathes being especially mentioned in this connection.

NEW YORK

The outlook for the last month in the current year in this market is reported to be better than it was in the past few years. A large number of orders are pending and it is definitely known by dealers in the territory that many of them will be closed before the end of the year. On the other hand, there are some substantial orders being held up until new financial appropriations are made for 1928.

November business was satisfactory in most lines. Sales of high production machines were good; radial drills, centerless grinders, brakes and jig borers exceeded the sales of any other types. In the last week of the month orders were received for shapers, lathes, die sinkers, millers and a 10-ton crane. The used tool market also showed some signs of activity with the reported sale of a hand screw machine, a shaper, two drilling machines, a surface grinder, and a sizable list of standard tools for export.

CINCINNATI

Machine tool manufacturers in the Cincinnati district report that business held up to its former level in the past week, and in some cases it is stated that there was a gain over the previous week. Manufacturers of large tools, who do not gage their business by weekly sales variations, state that trade conditions have improved materially in the past month.

While no great amount of business has accumulated on order books, manufacturers point out, sufficient orders are flowing in from day to day to keep production at a good level. The week's market was sustained by purchases made by general machinists and miscellaneous users, whose orders called for single tools and replacements. There were some orders from railroads, automobile manufacturers and electrical concerns.

Manufacturers report that inquiries are coming in freely, several stating that these have a more "honest-to-goodness" tone than heretofore. This, it is thought, is at least due to some extent to current rumors here that machine tool prices are about to be increased.

DETROIT

Few orders have been received by machinery dealers within the past ten days and the character of the inquiries now being received indicates that there will be no immediate improvement of the market. There is a fairly good feeling throughout the trade but this is generally based on the expectation of better things for the new year rather than any immediate prospects.

The Paige plant shows some activity but it is not based on anything that will help the present situation. Quantities of equipment are being received and installed and plans for increased production are well under way. Chevrolet is planning to produce a new type motor by January and this may mean something to the trade.

Many of the small shops are idle with the exception of the tool shops. Employment is unchanged and the widespread rumors of large increases in the Ford personnel are in error.

British Machine Tool Builders Urged to Adopt American Production Models

Engineering industry rates low in business activity

By Our London Correspondent

IN ANY review of industrial conditions in Great Britain, engineering must take second place. Its condition as a whole does not please most people engaged in it, and yet it is assuredly more satisfactory than the condition of the coal industry, of the cotton and textile industries generally, or of the iron and steel industry.

Mention has been made before of the rebate offered by some steel manufacturers to users who confine their purchases to British-produced steel. The object is, of course, to increase home production, with reduction in overhead charges and therefore an ultimate cheapening of the product. The scheme has not yet had time to work out, but some people at least are diffident as to the prospect of success. In fact it is thought to be but a preliminary to an organized demand for a tariff. It is admitted that for many steel products the prices of continental products are markedly lower. Some approach to parity may be claimed in connection with steel plates for ships, but even here the continental output is at a definite advantage as compared with the export price of the corresponding British production; it is still more definitely below the home price for British material delivered locally.

Handicapped by Cartels

Great Britain is, of course, outside the agreement formed last year by Germany, France, Belgium, Luxemburg, and later by Austria and Czecho-Slovakia. This agreement, by which production was definitely allocated in proportion to the various countries concerned, has apparently been too much for British steel makers, particularly as regards exports, where special concessions were made. The steel output both of France and Germany has steadily risen during the past few years, while that of Great Britain has declined, until in 1926 it was only about equal to that of Belgium; the long-continued coal strike was however the main cause for the British decline that year, and 1927 will beyond question make a better showing. But Belgium in particular claims to be able to produce more cheaply, both on account of the lower wage costs and also because of more efficient and more modern plants. It is also claimed that in Great Britain heavier railway charges are incurred for transport, and that, in relation to other countries, excessive taxation and local rates, largely due to social services which are well beyond those of other countries, form a very severe handicap.

In engineering generally overseas trading for the current year has not been quite as good as was expected, though the decline at present is of slight importance. The comparison is with 1925; for a marked improvement, at any rate in the class known as machinery, can be reported as against last year, which, for the reason given before, is not a safe basis for comparison. It is to be noted that, despite the tariff imposed, the value of imports of complete motor cars is so far higher for this year. Imports of machinery have shown in increasing value for the last two years, and specially during the current year.

Trade in electrical goods, both export and import, is fairly stationary, a slight decline being evident at present in both classes as compared with 1925. As regards electrical machinery the electrical manufacturers' association regards the position with some satisfaction. It is suggested that the delay in the national re-organization of electrical supplies has been a handicap of late, but, on the other hand, the export trade has flourished. While old markets have been retained, electrical machinery is being sent to wider areas. It is thought that both in South America and in the East, British firms have lately been successful at the expense of American. As regards the home market, the rate at which electricity demand grows is held to suggest a shortage of plant before many months. The industrial motor market has improved, orders having been obtained from the coal mining, iron and steel and textile industries, but the position here is not regarded as altogether satisfactory. When, before long, details of the new supply systems are settled in certain of the industrial areas, it is expected that conditions for electrical manufacturers will improve.

Machine Tools Spotty

The machine tool section remains somewhat unevenly engaged. A few firms have found some measure of night work necessary; on the other hand, a still larger number of firms have experienced difficulty in keeping the shops running on a paying basis. It may be said that the demand has recently increased for medium-weight, high-production tools, and has fallen away for heavy tools. The dependence of the industry on demands from the automobile industry is a source of anxiety, and it is felt that other branches of engineering might well take their courage in their hands and order more freely. The success of the United States in providing high-production machinery for the automobile industry is a matter of general comment. It has led to some measure of direct copying, a process which it has usually been the pride of the British manufacturer to avoid. Indeed, on occasions he has been criticised for purposely avoiding accepted details of imported machines, using in their place something of his own devising, even if it were not quite equal. At the moment, however, there is quite a tendency to adapt and even copy accepted designs from overseas.

Some members of the machine tool industry are complaining that orders are not being received from the shipbuilding industry to anything like the extent that some reports suggest. The shipbuilding industry undoubtedly has improved. On the Clyde, for example, the tonnage put into the water has reached 333,000 tons, and in several areas the work in hand will provide a considerable amount of employment for the next few months. But considerable room for improvement exists and one Irish shipyard has been closed.

Program Ready for Welding Conference at Purdue

Manufacturers, plant managers, superintendents and foremen are invited to the three-day conference on welding which will be held Dec. 13, 14 and 15 at Purdue University, Lafayette, Ind. This is the third of the annual conferences at Purdue and considerable interest is being displayed in the discussions and demonstrations on electric, thermit and oxy-acetylene welding as applied to manufacturing operations. Prof. W. A. Knapp, head of the engineering extension department of the university, is in charge of the conference.

The technical program will include papers on: Welded Joints in Structural Work; Uses of Welding in Manufacturing Operations; Latest Developments in Thermit Welding; Welded Joints as a Mechanical and Structural Detail; Theory and Practice of Gas Cutting; Resistance Welding and Its Application to Welding Thin Plates; Replacing Castings by Means of Welded Frames; Pipe Welding; Welding Rods.

The exhibits and demonstrations will include: Modern Welding Equipment; Electric, Gas and Thermit Welding; Aluminum Welding; Hand Cutting; Mechanical Cutting; Bronze Welding; Pipe Welding; Stelliting.

Implement Exports Steady

Exports of agricultural implements from the United States during the first nine months of 1927 totaled $72,000,000, a few thousand dollars greater than the shipments in the same period of 1926, according to the Department of Commerce. This increase, slight as it is, evidences the stimulation in export trade which has occurred during the third quarter of the year. Shipments during the first six months of the year were $5,780,866 less than those during the first half of 1926, and for the most part the monthly shipments during that period were less than those of 1926.

Machine Tool Congress Will Take Part in A.S.M.E. Sessions

An invitation to join in the sessions of the Machine Shop Practice Division of the American Society of Mechanical Engineers, at the annual meeting of the society in New York, has been accepted by the Machine Tool Congress. The discussions of machine shop methods will be divided into three groups, each group covering a half day. The first session will be held on Dec. 6 and will be a symposium on hydraulic feeds for machine tools. W. F. Dixon, works manager, the Singer Manufacturing Co., will preside.

On the afternoon of the same day there will be a symposium on plant equipment maintenance, presided over by C. R. Burt, vice-president of the Pratt & Whitney Co., and president of the Machine Tool Congress. Five papers will be presented and a general discussion will follow.

The third and last session of the division will be held on the morning of Dec. 7. The progress report of the Machine Shop Practice Division will be presented by L. C. Morrow, managing editor of *American Machinist*, who is chairman of this division. Only one other paper will be presented at this session, that one dealing with the development of machine tools.

A Correction

In our account of the flood conditions in New England, published in the issue of Nov. 17, it was stated that the cutter department of the Fellows Gear Shaper Co., at Springfield, Vt., was flooded. We have been asked to amend this statement, as only the lower or assembly floor was flooded. The cutter department is on the second floor of the building.

Business Items

The R. B. F. Ball Bearing Co., of New York, is the new name of the General Bearing Co.

The John Goodison Thresher Co., Sarnia, Ontario, has bought the plant in that city formerly occupied by the Perfection Stove Co.

The National Radiator Co. has completed plans for taking over the Pacific Steel Boiler Corporation. It is planned to merge the latter firm with the parent organization.

The American Radiator Co. has acquired the American Blower Co., of Detroit. The organization of the latter company will remain intact, but the business will be conducted by a new organization to be known as the American Blower Corporation.

The Advance Machine Tool Co. has been formed in Toronto, Canada, by Clifford Cornwall, formerly connected with the Canada Illinois Tool Co., Toronto. The new company will act as agent for labor saving machinery, tools and specialties.

The sales and executive offices of the Wilmarth & Morman Division of the Machinery Company of America have been moved to Big Rapids, Mich. The factory has been moved to the Covel Branch at Benton Harbor, Mich.

Consolidation of the Republic Iron and Steel Co. and the Trumbull Steel Co. was approved by the directors of both companies on Nov. 25. The new organization will have combined assets of nearly $200,000,000 and it is stated that stockholders of both companies favor the merger and will vote its approval at an early date.

Extensions and improvements are being made to the plant of E. Long, Ltd., Orillia, Ontario, manufacturer of saw mill and mining machinery. The company recently installed electric rivet heaters, a traveling crane, a large boring mill and radial drills. This company is now making elevating and conveying equipment for use in factories, mines and pulp mills.

The assets of the firm of Matthew Moody & Sons Co., Montreal, manufacturers of farm machinery, have been sold to Hale, Perusse & Co., Ltd. A new company is being formed under the name of Matthew Moody & Sons Co., Ltd. The old firm of Matthew Moody & Sons Co. has been manufacturing machinery for over 82 years.

Bredt, Hirsch & Co. has been organized with headquarters at 27 Ansbacher St., Berlin, W50, Germany. The new firm will specialize in consulting engineering and industrial management problems. Dr. Bredt is a well-known industrial engineer and accountant, having recently been associated in industrial research work in Russia. Dr. Hirsch is Doctor of Economy in Jena University and was the founder and for many years manager of the German Machine Tool Manufacturers' Association.

Personals

W. W. NICHOLS, of Detroit, has been honored by election to membership in the Institute of Scientific Management at Warsaw.

W. W. COLEMAN has been elected president of the Bucyrus-Erie Co., a merger of the Erie Steam Shovel Co., of Erie, Pa., and the Bucyrus Co., of Milwaukee.

A. H. MCDOUGALL has been elected vice-president and director of sales for the Whiting Corporation, manufacturer of foundry and railway equipment, of Harvey, Ill.

H. W. HOW has been appointed consulting engineer for the Struthers-Wells Co., of Warren, Pa. He was formerly chief engineer for the Buffalo Foundry and Machine Co.

A. M. WIBEL has been appointed purchasing agent for the Ford Motor Co., succeeding Fred Diehl, who resigned. Mr. Wibel has for some time been in charge of equipment purchases for the company.

PROF. LEONIDE RAMZINE, director of the Thermotechnique Institute of Moscow, Russia, will speak at a meeting of the Russian Association of Engineers in the Hotel Pennsylvania, New York, Friday evening, Dec. 9.

GEORGE H. YOUNG, formerly general manager of the Photogenic Machine Co., of Youngstown, Ohio, has returned to Binghamton, N. Y., to resume active charge of the Binghamton Engineering Co., of which he is president.

R. M. PLYMPTON has been appointed sales manager of consumer motor business in the Chicago office of the Lincoln Electric Co., of Cleveland. Mr. Plympton was formerly assistant sales manager for the Babson Statistical Association.

GALEN SNOW for the last five years advertising and sales promotion manager for the Greenfield Tap and Die Corporation, Greenfield, Mass., has resigned and is now treasurer of W. B. Remington, Inc., Springfield, Mass., a national advertising agency.

FRED SCHYTTE has been appointed general manager of the Canada Illinois Tools, Ltd., Toronto, Ontario. Mr. Schytte was with the parent plant of the Illinois Tool Works at Chicago, where he was assistant to the chief engineer. He has had long experience in the cutting tool, jig and fixture field.

ALFRED L. CARLSON has been appointed sales engineer in the Eastern territory for the Giddings & Lewis Machine Tool Co., of Fond du Lac, Wis. Mr. Carlson was formerly associated with the Gisholt Machine Co., and with Henry Prentiss & Co. He will have headquarters in New York City.

A. N. GODDARD, president and general manager of the Goddard & Goddard Co., Inc., manufacturer of milling cutters, of Detroit, was presented with an automobile by the employees of the plant on the tenth anniversary of the founding of the company. The gift was in appreciation of his management policies.

Calendar of Local Meetings

American Society of Mechanical Engineers

Tri-Cities. Dec. 8. Rock Island Arsenal Cafeteria, Rock Island, Ill. Subject: "Centerless Grinding," by J. E. Caster, Cincinnati Grinders Corporation.

Buffalo. Dec. 13. Hotel Statler, evening. Subject: "The Present Standing of the Various Standards Now Being Developed for Valves and Fittings for High Pressure Steam Service," by F. H. Morhead, chief engineer, Walworth Company.

Forthcoming Meetings

American Institute of Weights and Measures. Annual meeting at the headquarters of the Institute, 115 Broadway, New York City, Thursday afternoon, Dec. 8. W. E. Bullock, secretary, 115 Broadway, New York.

American Society of Mechanical Engineers. Annual meeting, Engineering Societies Bldg., New York City, Dec. 5 to 8. C. E. Davies, assistant secretary in charge of meetings, 29 West 39th St., New York City.

National Exposition of Power and Mechanical Engineering. Sixth annual event in the Grand Central Palace, New York, Dec. 5 to 10. Charles F. Roth, manager, Grand Central Palace, New York City.

Power Transmission Association. Annual meeting, Dec. 7, Hotel Commodore, New York City. W. S. Hays, secretary, Drexel Bldg., Philadelphia.

American Association for the Advancement of Science. Second Nashville meeting, Nashville, Tenn., Dec. 26-31, general headquarters Andrew Jackson Hotel. General chairman, W. S. Leathers, M.D., professor of preventative medicine and public health, Vanderbilt Medical School, Nashville, Tennessee.

Obituaries

BRUCE W. BENEDICT, professor of engineering in the University of Illinois, died at Urbana on Nov. 22.

REAR ADMIRAL W. H. G. BULLARD, retired, chairman of the Federal Radio Commission, died suddenly in Washington, D. C., on Nov. 24.

T. HOWARD BARNES, consulting engineer, prominent for his work among Latin American countries, died in Lima, Peru, on Nov. 15.

WILLIAM L. BELKNAP, JR., treasurer and general manager of the Belknap Manufacturing Co., Bridgeport, Conn., maker of brass couplings, gages and valves, died suddenly on Nov. 23 at his home in that city.

CHARLES B. MANVILLE, founder of the Johns-Manville Co., died at his home in Pleasantville, N. Y., on Nov. 27. He was 93 years old. Mr. Manville retired from active business in 1902, the company having been managed by his sons since that time.

JAMES NEWTON GUNN, well-known automotive production engineer, and formerly general manager of the Studebaker Corporation of America, died on Nov. 26 at his home in New York City. Mr. Gunn was a director of the United States Rubber Co., and president of the United States Tire Co. He was a member of the administrative board of the Harvard University business school, and was also active in the affairs of Columbia University and the Massachusetts Institute of Technology.

The Weekly Price Guide

Rise and Fall of the Market

MOVEMENT of prices on shop materials and supplies used in the metal working trades, is upward, compared with levels of a week ago, in the following: brass and copper sheets, wire, rods, bars, and tubing, solder, copper, tin and zinc. Price advances occurred principally in the West. Declines of the week affected the following: scrap lead and zinc, at New York; cold drawn steel, strip steel and fuel, at the principal centers of production. Demand is unseasonally heavy in reinforcing bars; shapes are gaining; there is considerable activity in lap-weld steel pipe. Slowness prevails in current buying of pig iron (except foundry), steel sheets, and iron and steel scrap. The three principal hot-rolled steel products are $1.80 per 100 lb., base, Pittsburgh, in large tonnages; $1.85 for carlots; and $1.90 for less-than-carload quantities. Prices of bars, shapes and plates show increasing firmness.

(All prices as of Nov. 25)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$21.44
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.62
BIRMINGHAM	
No. 2 Foundry	16.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	21.26
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.80
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50@4.75
Cleveland	5.00
Cincinnati	4.30
New York	4.75@5.25
Chicago	4.75@5.25

SHEETS—Quotations are in cents per pound in various cities from warehouse: also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.10@2.15	3.50	3.25	3.89
No. 12	2.15@2.20	3.55	3.30	3.94
No. 14	2.20@2.25	3.60	3.35	3.99
No. 16	2.30@2.35	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.70@2.80	3.75	3.55	4.00
No. 22	2.85@2.95	3.90	3.70	4.15
No. 24	2.90@3.00	3.95	3.75	4.20
No. 26	3.00@3.10	4.05	3.85	4.30
No. 28	3.25@3.35	4.20	4.00	4.45
Galvanized				
No. 10	2.95@3.05	4.10	3.80	4.25
Nos. 12 to 14	3.05@3.15	4.20	3.90	4.35
No. 16	3.15@3.25	4.30	4.00	4.45
No. 18	3.30@3.40	4.45	4.15	4.60
No. 20	3.45@3.55	4.60	4.35	4.75
No. 22	3.50@3.60	4.65	4.40	4.80
No. 24	3.65@3.75	4.80	4.50	4.95
No. 26	3.90@4.00	5.05	4.75	5.20
No. 28	4.15@4.25	5.30	5.00	5.45

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft. or 100 lb.:

— Thickness — B.w.g. and Fractions	Decimal	Outside Diameter in Inches ¼	⅜	½	⅝	1	1½	1¼
		Price per Foot						
20	.035"	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
18	.049"	.17	.18	19	.20	21	23	25
16	.065"	.19	20	.21	.22	23	25	27
14	.083"	.20	.22	.23	.24	.25	.27	29
13	.095"	.21	.23	.25	.26	.27	.29	31
12	.109"	.22	.24	.26	.27	.28	.30	32
11	.120" or 125"	.23	.25	27	.28	.29	.31	.33
10	134"	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	....	4.65
Spring steel, heavier	4.00	....	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	5.70	6.10
Floor plates	5.25	5.30	5.00
Cold drawn, round and hex.†	4.00	3.65	3.60
Cold drawn, flats and squares	4.50	4.15	4.10
Structural shapes	3.34	3.00	3.10
Soft steel bars	3.24	3.00	3.00
Soft steel bar shapes	3.24	3.00	3.00
Soft steel bands	3.99	3.65	3.65
Tank plates	3.34	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, ⅛, 8 35c.: ¼, 7.85c.: ⅜ to ½, 7.35c. per lb. *Flat, ⅛@½-in. thick. †also shafting and screw stock.

METALS

Current Warehouse Prices in Cents Per Pound for Small Lots

Copper, electrolytic, up to carlots, New York			15.00
Tin, pigs, 5-ton lots, New York			60.12½
Lead, pigs, up to carlots, E. St. Louis	6.05	New York	6.87½
Zinc, slabs, up to carlots, E. St. Louis	5.85	New York	6.75

	New York	Cleveland	Chicago
Antimony, slabs, ton spot	13.25	14.00	13.00
Copper sheets, base	22.25	22.50	22.00
Copper wire, base	18.75	19.50	15.25*
Copper bars, base	21.75	22.00	21.50
Copper tubing, base	24.00	24.50	24.00
Brass sheets, high, base	18.25	18.50	18.25
Brass tubing, high, base	23 12½	23 37½	23 12½
Brass rods, high, base	16.00	16.25	16.00
Brass wire, high, base	18.75	19.00	18.75

*Mill

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	24.37½@25	26@27	26.02
Zinc sheets (casks)	11.00	11.55	10.11
Solder (½ and ½), (case lots)	35.75	37.50	34@38
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade			75.00
Commercial genuine, intermediate grade			61.00
Anti-friction metal, general service			31.50
No. 4 babbitt (f.o.b.)			12.50
Nickel, f.o.b. refinery, cents per lb.:			
Ingots 35.00 Electrolytic 37.00 Shot			36.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	45.00
Cold drawn rods, Grade "A" (base)	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	28.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible copper	11.62½@11.87½	10.75	10.00@10.50
Copper, heavy, and wire	11 12½@11.62½	10.75	9.75@10.25
Copper, light, and bottoms	10 00 @10 25	9.25	8.75@ 9.25
Heavy lead	5 00 @ 5 25	5.25	4.50@ 5.00
Tea lead	4.00 @ 4.25	3.75	3.50@ 4.00
Brass, heavy, yellow	7 00 @ 7.50	7.00	6.75@ 7.25
Brass, heavy, red	9.00 @ 9.50	9.50	8.75@ 9.25
Brass, light	5.25 @ 5.75	5.50	5.75@ 6.25
No. 1 yellow rod turnings	7.25 @ 7.75	7.00	6.75@ 7.25
Zinc	3.25 @ 3.50	3.25	2.50@ 3.00

TIN PLATES—Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13½	$0.16	$0.15@0.20
Cotton waste, colored, per lb.	.09@ .13	.12	.12@ .17
Wiping cloths, washed white, per lb	.15½@17½	36.00 per M	.15
Sal soda, per lb	.03½	.02	.02½
Roll sulphur, per lb	027	.03½	.04
Linseed oil, raw, per 7½-lb. gal., 5 bbl. lots	.79½	.94	.83
Lard cutting oil, 25% lard, in 5 gal. cans, per gal.	.65	.50	.50
Machine oil, medium-bodied (55 gal. metal bbl.), per gal.	.27	.35	.26
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	35%	35%	35%
Heavy grade	30%	30%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%*
Second grade	50–10%	60–5%	50–10%†

*Large quantities, 60%. †Large quantities, 60-10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.04
Brass rods	per lb.	.16	.16	.16625
Solder (½ and ½)	per lb.	.35¾	.36¼	.43
Cotton waste, white	per lb.	.10@13½	.10@.13½	.13@.17½
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.10
Lard cutting oil	per gal.	.65	.65	.55
Machine oil	per gal.	.27	.27	.35
Belting, leather, medium	off list	35%	35%	40–5%
Machine bolts, up to 1x30 in., full kegs	off list	50%*	50%*	40%

*New list April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
*Flint paper	$5.13	$4.95	$5.13
*Emery paper	10.71	9.15	10.71
*Emery cloth	27.84	27.85	27.84
Emery disks, 6 in. dia., No. 1, per 100:			
Paper	1.29	1.27	1.32
Cloth	3.10	3.05	3.05
Fire clay, per 100 lb. bag		.75	.75
Coke, prompt furnace, per net ton		Connellsville,	2.75@3.00
Coke, prompt foundry, per net ton		Connellsville,	3.75@4.50
White lead, dry or in oil,	100 lb. kegs	New York,	13.75
Red lead, dry,	100 lb. kegs	New York,	13.75
Red lead, in oil,	100 lb. kegs	New York,	15.25

*4½ reams and under.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in.	55%
Larger up to 1 x 30-in.	50%
1⅛ and 1¼ in. dia.	35%
Carriage bolts:	
Up to ¾ x 6-in.	55%
Larger sizes	50%
Coach and lag screws:	
Up to ¾ x 6-in.	55%
Larger sizes	50%
Tap bolts, hexagonal heads	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl.	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in., incl.	55%
Semi-finished, hexagonal, tapped, in packages, all sizes	40%
Case hardened, hexagonal, tapped, in packages, all sizes	30%
Washers: Deduct from list, per 100 lb.	$3.50*
Rivets, button and cone head:	
Small, including ⅛-in. dia.	50–10%
Large (base) per 100 lb. net	$5.00†

Note—For less than case or keg quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.

*Broken keg lots, $1.50 off list. †Broken keg lots, $6.50 net.

Machine Requirements and Industrial Construction

Equipment Wanted

Mass., Cambridge (Boston P. O.)—New Method Dye Co., 30 Cross St.—power jig saw, etc.

Mass., Everett (Boston P. O.)—Melanson Bros Inc., 67 Chelsea St.—tools and general equipment for proposed 1 story, 75 x 115 ft. auto repair shop. Estimated cost $40,000.

Mass., Hudson — Clark's Chevrolet Co., Main St.—tools and general equipment for proposed 1 story garage and repair shop. Estimated cost $40,000.

Mass., Newburyport—Henchey Motor Co., Bridge Rd.—miscellaneous tools and equipment for proposed 1 story, 75 x 90 ft. garage and repair shop. Estimated cost $45,000.

Mass., Somerville (Boston P. O.)—F. G. Volpe, Hager St. Arlington—machinery and equipment for proposed foundry and machine shop at 14 Kent St. here.

Mass., Webster—H. Cohen, 63 Main St.—miscellaneous tools and equipment for proposed repair and service garage on Main St. Estimated cost $50,000.

Mich., Detroit — Detroit Body Die Co., 3450 Wight St.—planer for use in body die shop.

Mich., Detroit—Hudson Motor Car Co., 12601 East Jefferson Ave.—equipment for handling automobile bodies into and from storage for proposed 2 story auto body storage building. Estimated cost $125,000.

Mo., St. Louis—Benwood-Linze Co., 1830 Washington Ave.—sander or horizontal disc grinder.

N. Y., New York—Dept. of Purchase, P. J. Dooling, Comr.—will receive bids until Dec. 2 for steam hammers for Dept. of Street Cleaning.

Ore., Klamath Falls—Weyerhaeuser Timber Co., Tacoma Bldg., Tacoma, Wash., G. Long, Mgr.—machinery and equipment for proposed saw and planing mill here. Estimated cost $250,000.

R. I., Woonsocket—Simplex Tool Co.—6 ft. squaring shear for 18 gage metal, also straight line press to take stock up to 6 ft. in width, 18 gage.

Tenn., Nashville—Davidson County Highway Dept., 46 Court House—screw cutting lathes, drill presses, planers, shapers, milling machine and power hack saw.

Ont., Toronto—Canadian Paperboard Co., H. O. 2 Leigneurs St., Montreal, Que.—electric cranes, etc. for proposed 1 and 2 story, plant here. Estimated cost $1,000,000.

Opportunities for Future Business

Ala., Mobile — Bd. of Revenue & Road Comrs., E. C. Doody, Clk., will soon award contract for the construction of a machine shop and garage for County Poor Asylum.

Calif., Huntington Park—S. Karpen & Bros., c/o Hamm, Grant & Brunner Inc., Ferguson Bldg., Los Angeles, archts., manufacturers of furniture, are having plans prepared for a 4 story factory on Irvington St. here. Estimated cost $250,000.

Calif., Los Angeles—Bauman Bros., 6527 McKinley St., manufacturers of furniture, had plans prepared for a 2 story, 60 x 165 ft. factory at St. Andrews Pl. between 62nd and 63rd Sts. Estimated cost $75,000. H. K. Boone, Higuera Bldg., Culver City, Archt.

Calif., Los Angeles—Standard Boiler & Steel Works, G. J. Kuhrts Jr., Gen. Mgr., 221 Queirolo St., is having plans prepared for a 1 story, 70 x 240 ft. boiler shop. Estimated cost $40,000.

Calif., Los Angeles — Sterling Electric Motors Inc., 124 West 4th St., had plans prepared for first unit of factory, 100 x 100 ft. at Telegraph Rd. and Atlantic Ave. Estimated cost $40,000. C. F. Plummer, 1108 Story Bldg., Archt.

Conn., Norwalk—E. H. Hotchkiss, 6-12 Hoyt St., manufacturers of clips, will soon award contract for a 2 story, 128 x 143 ft. factory. Estimated cost $75,000. Ballinger Co., 105 South 12th St., Philadelphia, Archt. Noted Nov. 10.

Conn., Waterbury — American Fastener Co., 54 Maple St., awarded contract for a 4 story, 40 x 105 ft. factory. Estimated cost $75,000. Noted Oct. 27.

Ga., Atlanta—Chevrolet Motor Co., General Motors Bldg., Detroit, Mich., is having plans prepared for a 1 story, 50 x 250 and 50 x 260 ft. auto manufacturing plant on Sawtell Rd. here. A. Kahn, 1000 Marquette Bldg., Detroit, Mich., Archt.

Ill., Chicago—C. G. Spring Bumper Co., 1455 West 38th St., manufacturers of auto bumpers, plans addition to factory at 1449-1463 38th St. W. Estimated cost $20,000. H. E. Gallup, 646 North Michigan Ave., Archt.

Ia., Council Bluffs—International Harvester Co. of America, 606 South Michigan Ave., Chicago, Ill., awarded contract for a 145 x 181 ft. service station. Private plans.

Ia., Marshalltown—Fisher Governor Co., will build a 1 story, 20 x 75 ft. addition to factory. Estimated cost $45,000. Noted Nov. 17.

Me., Portland — Winslow & Co. Inc., Forest Ave., manufacturers of machinery, plans reconstruction of factory recently destroyed by fire. Estimated cost $250,000. Webster & Libby, 11 Exchange St., Archts.

Md., Baltimore—E. J. Rosenstein, Equitable Bldg., is having plans prepared for a 2 story garage at 39th and Canterbury Rd. Estimated cost $250,000. Private plans.

Mass., Cambridge (Boston P. O.)—Cambridge Sheet Metal Co., 295 Franklin St., is receiving bids for the construction of a 1 story, 60 x 85 ft. additional unit to auto body plant. E. T. P. Graham, 171 Newbury St., Foston, Archt.

Mass., Dorchester (Boston P. O.)—Pickwick Garage, c/o L. Kopzynski, 80 Federal St., Boston, Archt., is receiving bids for a 1 story, 60 x 160 ft. garage and repair shop at 711 Columbia Rd. here. Estimated cost $40,000.

Mass., Dorchester (Boston P. O.)—Skinner Organ Co., 197 Sydney St., awarded contract for a 3 story factory. Estimated cost $40,000.

Mich., Detroit—Gorham Tool Co., 2206 Twelfth St., awarded contract for a 1 story, 60 x 126 ft. machine shop on West Wilson St. Estimated cost $50,000.

Minn., Hastings—Hudson Mfg. Co., 324 Third Ave. N., Minneapolis manufacturers of sheet metal products, cupolas, farm machinery, etc. awarded contract for addition to factory. Estimated cost $50,000. Noted June 9.

Minn., Minneapolis — Jonas Rosenberg, 2635 Girard Ave. S., is havng plans prepared for a 1 story, 83 x 120 ft. repair and service garage at Hennepin Ave. and 24th St. Estimated cost $45.000. P. E. Crosier, 916 New York Life Bldg., Archt.

Minn., St. Cloud—Donlin-Johnson Co. awarded contract for a 60 x 140 ft. millwork factory, 40 x 120 ft. warehouse and 20 x 140 ft. lumber shed. Private plans.

Mo., Kansas City—United Motor Service Inc., 2701 Warwick Blvd., is having plans prepared for a 2 story, 100 x 125 ft. service station at 25th and McGee Sts. Estimated cost $40,000. R. H. Sanneman, 519 Lee Bldg., Archt.

Mo., St. Louis—Century Electric Co., 1806 Pine St., plans the construction of a 1 story foundry at Spring and Market Sts. Estimated cost $200,000. L. B. Pendleton, 73 DeMenil Bldg., Archt.

Neb., Lincoln — McGrew Machine Co., 2124 Y St., awarded contract for a 2 story, 50 x 55 ft. factory at 2140 Y St. Private plans.

Neb., Omaha—Nebraska Buick Auto Co., Lee Huff, V. Pres. and Mgr., will soon receive bids for a 2 story, 99 x 136 ft. garage at 502 South 19th St. Estimated cost $100,000. J. T. Allen and N. S. Wallace, 223 Brandeis Theatre Bldg., Archts.

N. J., Hoboken — Bamboo & Rattan Works, 901 Jefferson St., will build a 1 story, 100 x 200 ft. factory. Estimated cost $75,000. Private plans.

N. J., Hoboken—Model Garage Inc., 208 Clinton St., plans a 2 story addition to garage. Estimated cost $150,000. Private plans.

N. J., Jersey City—H. Byrne, 392 Mercer St., is receiving bids for a 1 and 2 story, 200 x 300 ft. garage at Mill Rd., Mercer and Wayne Sts. Estimated cost $150,000. A. Davis, 140 Montgomery St., Archt. Noted Oct. 20.

N. J., Paterson — Wright Aeronautical Corp., 238 Lewis St., awarded contract for a 1 story factory and assembly plant. Estimated cost $75,000.

N. Y., New York—Dept. of Water Supply, Gas & Electricity, N. J. Hayes, Comr., awarded contract for a repair shop at 28-32 Vandewater St. Estimated cost $62,890.

O., Cincinnati—Broadway Garage Inc., 521 Sycamore St., plans the construction of a 7 story, 150 x 200 ft. garage. Estimated cost $500,000. Rendigs, Panzer & Martin, 609 Southern Ohio Bank, Archts.

O., West Union—Dept. of Highways & Public Works, G. F. Schlesinger, Dir., Ohio-Hartman Bldg., Columbus, is having sketches made for a 1 story repair and service garage. Estimated cost $50,000. H. B. Briggs, Ohio-Hartman Bldg., Columbus, Archt.

Pa., Neville Island (Pittsburgh P. O.)—Witherow Steel Co., awarded contract for a 1 story, 50 x 240 ft. addition to machine shop. Estimated cost $60,000.

Pa., Philadelphia—Delaware Bridge Bus Assn., c/o H. S. Shertz, Liberty Bldg., plans the construction of a bus terminal at 13th and Filbert Sts. Estimated cost $3,000,000. Architect and engineer not selected.

R. I., Providence — Brier Mfg. Co., 70 Ship St., jewelry manufacturers, is having plans prepared for the construction of a factory. Estimated cost $70,000. F. B. Perry, 44 Franklin St., Archt.

W. Va., Wheeling—Anthony Fokker of Fokker Aircraft Corp., c/o L. Spencer, 383 Madison Ave., New York, N. Y., plans the constructon of a factory for the manufacture of commercial planes, here. Estimated cost $1,000,000.

Wis., La Crosse — National Gauge & Equipment Co. awarded contract for a 1 story, 130 x 135 ft. addition to factory. Merman & Skogstad, Archts.

Wis., Marshfield—Marshfield Canning Co. is receiving bids for a 1 story, 32 x 64 ft. addition to factory and 1 story, 64 x 100 ft. addition to warehouse. Prvate plans.

Ont., Toronto—D. E. Bennett, Temple Bldg., plans the construction of a 15 or 20 story garage and office at York and King Sts. Estimated cost $2,000,000. Architect and engineer not selected.

Ont., Toronto—Canadian Paperboard Co., H. O. 2 Leigneurs St., Montreal, Que., awarded contract for a 1 and 2 story paperboard mill including 1 story, 60 x 60 ft. machne shop, etc. on Commissioners St. here. Estimated cost $1,000,000.

Ont., Toronto—M. Brown, Confederation Life Bldg., Archt., is receiving bids for a 3 story, 150 x 150 ft. garage, etc. on Gerrard St. E. for A. L. Garrie & Co., 354 Victoria St. Estimated cost $200,000.

Ont., Toronto—Toronto Motor Car Co., 120 Adelaide St. E., awarded contract for a 2 story, 149 x 145 ft. garage at Yonge St. and Orchard View Blvd. Estimated cost $175,000. Noted Nov. 17.